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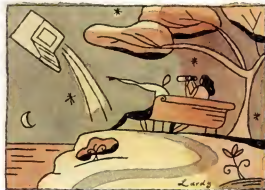
Tired of that same old PC? Then "The New PCs", our cover story, is what you've been waiting for. The package of stories in this issue reports our scrutiny of the new hardware plat-

forms and the new operating systems that are going to challenge the Intel/MS-DOS alliance that has dominated the PC market for more than a decade.

This year will probably be remembered for its serious outbreak of computing contenders. New desktop machines from Apple, DEC, HP, IBM, Silicon Graphics, and Sun go up against a machine based on Intel's new

reviewers remarkably frank about the shortcomings of Ye Olde PC when compared with these new machines. Remembering that there are platform zealots as well as operating system fanatics, our new Graphics Hardware associate editor, Michael Neubarth, did a thorough job of sorting through the rivalries and prejudices to pull together a series of thoughtful, balanced articles.

Hardware without software is just a lot of plastic and metal. That's why we have also focused on the 32-bit PC operating systems: IBM's OS/2 2.1, Microsoft's Windows NT, and seven 32-bit GUI versions of Unix.



Pentium microprocessor. After years as a near-monopoly, DOS is suddenly put to the test by new or improved 32-bit operating systems from IBM, various Unix vendors, and even Microsoft itself, under the guise of Windows NT.

Our second annual Platforms issue also compares the strengths and weaknesses of the hardware products, focusing on what each does well. Understandably, some will accuse us of being too PC-centric, but we think you'll find our

Both IBM's and Microsoft's entry were in late beta stage when we looked at them, as were SunSoft's Solaris and NeXT's NeXTStep, two of the Unix versions for the Intel platform. We could not deliver final performance results for some new products, but we will run performance tests on them when we get final shrink-wrapped versions, and we will report the results to you. Meanwhile, read here about your next dream machine.—Joel Dreyfuss

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Computers

The New PCs

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Cover photograph by Christopher Gould

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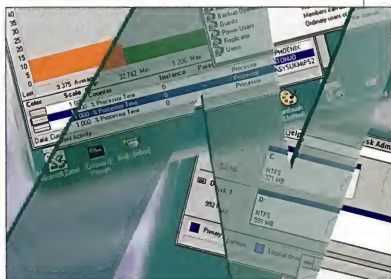
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Unix on Intel:
The Beast Turns Beauty

BY DAVID S. LINTHICUM AND STEVEN A. VAUGHN-NICHOLS Now that it speaks DOS and Windows and hides its powerful 32-bit operations beneath sophisticated, friendly GUIs, Unix finally stands a chance at cracking the mainstream marketplace. Can a united Unix head off NT?.....219

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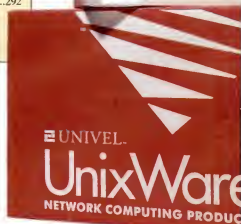
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Best of a New Breed:
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Photographs of CD and software by Thom O'Connor

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Take a fantastic voyage inside the human body with Body Illustrated (page 466).




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Scitor Corporation

The Leader Of The Pack In Windows Comm Software.

Naturally, you'd expect us to say that Crosstalk® for Windows is the biggest, baddest comm software around. But the experts agree with us: For both ease-of-use and power, Crosstalk blows past the other Windows™ comm programs—including Procomm Plus® for Windows. So hop on, and let's hit the road.

Born To Communicate.

Ever since Crosstalk for Windows was introduced, it's been a top pick of reviewers everywhere.

Crosstalk for Windows sets the performance bar even higher for competitors in the Windows communications market.

—PC World, October 1992

But its newest release has really brought the raves rolling in.

PC World says Crosstalk for Windows 2.0 "advances the state of the art in modem software." PC Today says our new interface is "extremely handsome, intuitive, and easy to use." And PC Sources calls it "a compelling communications

product" that's "as easy to use as a full featured communications software product can be."

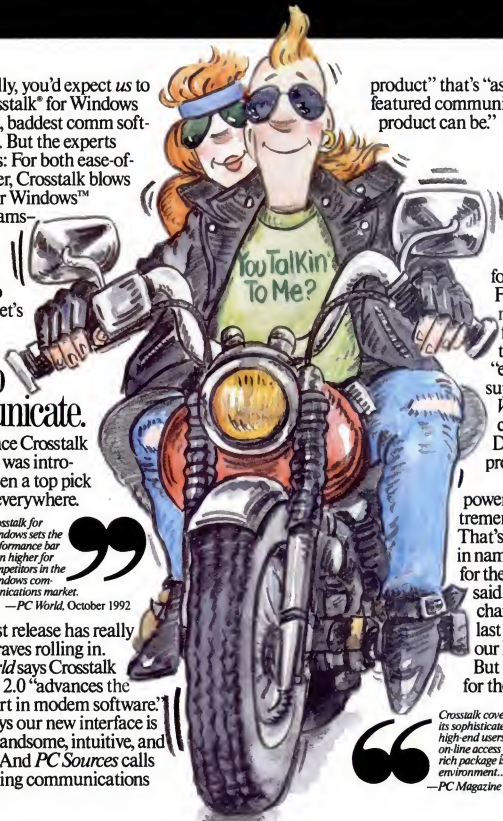
Easy-To-Use Rider.

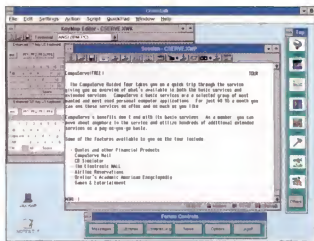
Crosstalk has always been known for its horsepower. Features like the terminal emulations and file transfer protocols that InfoWorld rated "excellent." And the superior speed that Windows Sources called "as fast as any DOS communication program."

But now all that power is combined with tremendous ease of use. That's why PC Magazine, in naming us Editors' Choice for the second year in a row, said, "This package has changed a great deal since last year, when it earned our Editors' Choice Award. But it has changed only for the better."

Crosstalk covers all bases with its sophisticated scripting for high-end users and quick on-line access for novices. This rich package is suitable for any environment....

—PC Magazine Editors' Choice, April 1993





"Even with all the added interface pizzazz, Crosstalk keeps an air of clean, no-nonsense functionality, unlike Procomm for Windows, which offers enough glitz to be distracting."

—PC World, October 1992

Crosstalk Leaves The Competition In The Dust.



June 20, 1992
Crosstalk for Windows
Version 2.0

Fact is, if you're ready for a Windows comm program, there are two products you're most likely to consider: Crosstalk for Windows and Procomm Plus for Windows. And reviewers have been

clear about their preference.

PC Magazine called our interface "elegantly designed" while noting that with Procomm Plus for Windows, "so many non-essential elements remain on-screen during terminal sessions." And Windows Sources commented that Crosstalk, "unlike Procomm for Windows, provides a full screen for sessions."

And when you have questions, here's what you'll find, according to *InfoWorld*: "DCA's technical support staff was very professional." They answered "with little or no delay and knew the

program thoroughly." On the other hand, they "tried to reach Datastorm technical support more than 30 times in two weeks. All we ever got was a busy signal!"

InfoWorld summed it all up: "Crosstalk is stronger than Procomm for Windows." 'Nuff said.

A Few Key Differences Between Them And Us	Crosstalk for Windows	Procomm Plus for Windows
Ease-of-Use Features		
Automatic Font Sizing	YES	no
Multiple Sessions	YES	no
Multiple Document Interface (MDI) Support	YES	no
Built-in Text Editor	YES	no
Built-in Script Editor	YES	no
Drag and Drop File Transfer	YES	no
Drag and Drop Keyboard Remapping	YES	no
Ready-to-Use Scripts for AT&T Mail, CompuServe, Delphi, Newsnet, Lexis/Nexis, OAG, VU/TEXT (Dialog)	YES	no
Power Features		
HP 700/94 and 2392A Emulations	YES	no
INDSFILE File Transfer Protocol	YES	no
Built-in NASI/NCSI LAN Support	YES	no

Ride With The Leader.

We hope all this has gotten your engines revved up a bit. Through August 2, 1993, registered users of Procomm Plus or any Crosstalk product (including earlier versions of Crosstalk for Windows) can upgrade to Crosstalk for Windows 2.0 for only \$49, by calling our toll-free number.

Give it a try, and you'll fall for the leader of the pack. And yes, we are talkin' to you.

**1-800-348-3221,
ext. 48A***



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LAN printers
smart enough to
connect to
your PCs, your
Macs, your
workstations, and
your future.

THE NEW IBM LASERPRINTER 4039



Five new LaserPrinters deliver 10, 12, or 16 pages per minute. And the smartest price/performance/connectivity package in the business.

There are five new LaserPrinters, with 10, 12, or 16 pages per minute, and fast RISC processors to maximize throughput. And each model gives you all this flexibility and connectivity. So you don't

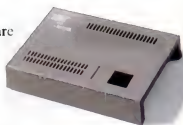


Two-sided printing is an option on every model, to save paper and filing space. And help save the environment.

have to buy a big, expensive printer to get multi-environment connectivity.

You get PostScript® and PCL5 compatibility standard. Up to three simultaneously active ports. And built-in intelligence called SmartSwitch, to choose the right language and right port for each job, automatically.

600 dpi is standard. So is PictureGrade™ processing, for sharper images. Upgradable code lets you add new capabilities. And there's a host of paper-handling options, including a snap-on duplexer, for the lowest-priced two-sided desktop printing in the business.



The optional IBM 4033 LAN adapter eliminates a dedicated print server, and expands your connectivity.

The new LaserPrinters are the latest from Lexmark, an independent, worldwide company formed from a division of IBM with a very simple business plan. Listen to what customers want. Bring it to market fast. Back it with quality, support, and responsiveness.

For your nearest dealer, call 1 800 358-5835 (in Canada, 1 800 663-7662).

And see LAN printers intelligent enough to put you on the cutting edge today. And keep you there tomorrow.

It's one thing to build intelligent printers. It's another to build intelligent investments. The new IBM LaserPrinter 4039 family by Lexmark is both.

For starters, a single internal network card connects the new IBM LaserPrinters to multiple network operating systems, *simultaneously*. And the card's flash memory lets you download new operating systems or update current ones, without touching the printer. So your printer stays compatible. And your investment stays intact.

Lexmark's Ethernet and Token-Ring cards give you bi-directional communications, too—so LAN managers can troubleshoot their printers without leaving their desks.

Add a Lexmark AppleTalk card and IBM 4033 external LAN



Select a single network card, and you're connected to all these operating systems simultaneously.

adapter (Token-Ring or Ethernet) and you can configure any LaserPrinter for just about any mix of environments—or reconfigure just as easily. (Either way, Lexmark's network-savvy Quick Start installer makes setup a fast, one-step process.)

CIRCLE 024 ON READER SERVICE CARD

IBM Personal Printers by

LEXMARK™

Make Your Mark

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FAMILY, BY LEXMARK. PRINT SMART.

Protection From Things You Can't Even See.

In Mr. Magoo's case, what he can't see covers lots of territory. For the rest of us, it includes things like invisible electronic emissions.

The more electronic equipment you work with, the greater the concern. That's why some monitor manufacturers offer models with VLMF (Very Low Magnetic Field) features. And charge extra for them.

But not Samtron. We were among the first to offer VLMF on our monitors. And now we build it into every advanced monitor.

For this, Samtron's extra charge is zero.

Another thing you won't see on these monitors is

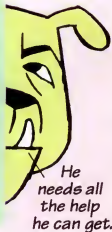
flicker. That's because they're built with non-interlaced technology.

It's a difference even Magoo can appreciate. Take our new flat-screen 15" color monitor (SC-528DXL), for example. Together with a fine-grained 0.28 dot pitch and 1,024x768 high resolution, it gives you a picture that is not only steady, but crisp and clean.

The same can be said of our economical 14" color monitor (SC-428TXL). Both are VGA and VESA compatible.

As we said, they all come with VLMF. Plus something else worth looking for.

The reliability of the Samtron name.



Advantages
Anyone
Can See

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Letters

GREEN BASHING

PC Magazine and Bill Howard should resist such trends as "The Politically Correct PC" (March 30, 1993) with all their energy. The so-called environmental movement is dominated by Socialist and other leftist groups that can't get their programs adopted on their own merits. Computers have no place in the world they are planning for us. Bill Howard would do well to consider the fact that many of the physical and chemical processes that are fundamental to manufacturing PCs would be outlawed or rendered more expensive if the "Greens" prevailed in the current debate. In fact, *PC Magazine* would be politically incorrect and lose its audience, since PCs would no longer be a mass-market item.

James F. Glass
Chatsworth, California



***"Computers have no place
in the world the 'Greens'
are planning for us."***

WATTS THE REAL DAMAGE

A typical PC does not draw 150 watts today. Tests show a range of 60 to 140 watts, with most drawing less than 100 watts. Bill Howard ("The Politically Correct PC") says a traditional system uses \$35 worth of electricity per year. If a traditional system draws 150 watts, the cost of electricity would have to be 2.7 cents per kilowatt hour. But, in fact, the national average is probably about 8 cents per kilowatt hour, with a range of 5 cents to 15 cents. An EPA "Energy Star" system drawing 60 watts would have to buy electricity at 2.3 cents per kilowatt hour in order to cost \$12 per year to operate.

Howard also states that it takes 1.5 watts of cooling energy to offset each watt of PC energy. That is not correct. A typical air conditioning unit adds about 0.3 watts for each watt of PC use.

Lawrence G. Spielvogel
King of Prussia, Pennsylvania

While pleased to see any airing of environmental matters in an influential computer magazine, I must take issue with Bill Howard's restatement of the widely held misconception that "a typical PC and monitor draws 150 watts today." That figure is hopelessly low.

The underestimate doubtlessly is caused by confusing input required with output supplied. Even the power supply of the original IBM PC, which was rated at a meager 63.5 watts of DC output, consumed 300 watts. My own 386/25 clone with a 200-watt power supply has, according to the statement on the power supply, a rated consumption of "90-130 VAC 6 AMP," or approximately 660 watts (110 volts times 6 amps). A 150-watt power supply would therefore consume 495 watts. A PC consuming 495 watts around the clock rather than 150 would cost \$346 per year in electricity, not \$105 as Howard concludes.

Norm Sabowitz
Halifax, Nova Scotia, Canada

• Volts times amps does equal watts, but what's stamped on the power supply only tells you the maximum safe load for the power supply, not that the PC is actually drawing anywhere near 660 to 720 watts. Two PCs we tested recently ("The Green Machine," May 25, 1993) drew 124 and 162 watts, including the monitors. (Some small, new systems may be closer to 100 than 150 watts.) Our calculation that contemporary PCs use \$35 of electricity yearly was based on a 150-watt system

running 9 hours each workday in a place where electricity costs 10 cents per kilowatt hour, as it does in the New York City area. You get roughly the same answer if it's 12 hours a day and 8-cent electricity, which is how the EPA does its calculation. A system left on around the clock burns \$105 to \$135 of electricity each year.—Ed.

HELLO, EGGHEAD? EUROPE HERE. COULD YOU SEND ME...

John C. Dvorak hit the nail on the head in his March 16, 1993, Inside Track when he criticized software companies' treatment of overseas users. I've lived outside the U.S. for nine years and have found it almost always cheaper to purchase software with a credit card from the U.S., with added costs of surcharges, airmail, and import duties, than to buy the same products off the shelf at "discount" dealers over here. And although I've registered many packages, I'm rarely notified of an upgrade. It's hard to justify the high prices paid here, and easy to see why virtually everybody I know with a computer has pirated software. Entertainment software vendors lead the pack in nonresponsiveness, though it seems they have the most to lose from piracy. There's a vast market for PC software outside the U.S.; I can't believe software makers won't acknowledge it.

Ed Senechal
Dortmund, Germany

THE FUTURE IS NOW

In "The Next Software Revolution" (March 30, 1993), Michael J. Miller writes that Microsoft, IBM, and Apple are "leading the way" to document-oriented computing, but he seems unaware that GO Corp. has had a document-oriented environment in its pen-based operating system, PenPoint, since it was released in April 1992. PenPoint supports not only the embedded objects but also embedded documents, where a drawing can exist inside a word processing document, which can exist inside a spreadsheet, and so on. What does the developer have to do in order to support this level of integration?

Now you can work with an instrument you're well versed in using — the pen — and still get full notebook functionality. Introducing the PenExec™ from AST. At first glance, it's a powerful portable computer with a large, clear screen. Then it quickly transforms into a pen-top, with a cordless pen for writing and navigating. You can take notes, annotate spreadsheets, sketch design changes or scribble Day-Timer entries.



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LETTERS

Absolutely nothing. All the behavior is inherited by each application from PenPoint's object-oriented architecture. How can other players be leading the way to a place where GO Corp. has already arrived?

Barry Boone
Seattle, Washington

• **You're absolutely right. PC Magazine recognized GO Corp.'s pioneering efforts at Fall Comdex '91, when we gave the company an Award for Technical Excellence (December 31, 1991).**—Ed

QWERTY IS STILL QUIRKY

I have noted quite a number of items in *PC Magazine* about "alternative" keyboard designs ("Keyboards Split," Trends, March 30, 1993). What these designs fail to recognize, however, is that breaking the keyboard in two in order to provide a more favorable hand/wrist angle is only half of the battle. These keyboards still feature a long-obsolete key layout.

When the QWERTY layout was designed in the early 1870s, touch typing had not even been thought of yet. The finger gymnastics required to touch type on a QWERTY keyboard are in large part responsible for many of the repetitive motion injuries associated with keyboards. It's time manufacturers improved this most basic user interface. Until all these new keyboards can provide custom layouts, though, none of them can truly be considered "ergonomic."

Randy Cassingham
Upland, California

A VIRUS BY ANY OTHER NAME...

In your review of our product, Victor Charlie ("Antivirus Software: Keeping Up Your Guard," March 16, 1993), you note that the program's signature library doesn't name viruses, and you describe this as idiosyncratic. On the contrary, it is the naming of viruses that is idiosyncratic. The 13 viruses used in your testing, for instance, are known by 47 different names. Both the flamboyant naming of

viruses and the intense task of identifying viruses and their strains arguably encourage the writing of new and different viruses.

One way we approached research was to develop an antivirus program to capture virus signatures on the fly, making it possible to detect and track new file-infecting viruses with no name of any kind. Indeed, many viruses will never have names. Detection of a large number of viruses is of no interest to the user with only one virus loose on his or her machine or network.

Alan Dawson
Bangkok Security Associates
Bangkok, Thailand

A FONT IS A FONT IS A FONT

I think it would be useful if *PC Magazine* printed a chart of equivalent Windows fonts. I had the TrueType fonts that come with Microsoft Windows 3.1. Later I purchased Bitstream's TrueType font package and MicroLogic's MoreFonts. While I don't have a large financial investment in fonts, I think I've spent my money unwisely because font manufacturers don't make it clear that one of their font styles under one name is nearly equivalent to a font under another name. For example, the MoreFonts Journal font could be a Courier font.

James Egan
North Tarrytown, New York

CORRECTIONS AND AMPLIFICATIONS

Since the Texas Instruments family of microWriter LED page printers was named as a hot prospect ("New & Improved," April 27, 1993), the PostScript versions have been upgraded to include more PostScript fonts at no extra cost. The microWriter PS17 is now the PS23 (with 23 PostScript fonts) and costs \$999; the PS35 is now the PS65 (with 65 PostScript fonts) and costs \$1,299.

In our January 26, 1993, review of 66-MHz 486DX2 systems, we indicated that Packard Bell did not participate because its system had been removed from the market. To clarify, when we requested a unit for review, Packard Bell was in the process of developing a new line of 486 PCs and chose not to send an older model. In January the vendor announced 60 new 486-based configurations, including 66-MHz 486DX2-based models.

In the same review of 66-MHz 486DX2 systems, we stated that the Hyundai 466D2 was the last of the company's older line of PCs. In fact, the system is the flagship desktop PC of Hyundai's new product rollout that took place in October 1992.

In the March 16, 1993, feature article "14- and 15-Inch Monitors: Mainstream Choices," we incorrectly reported that the Compaq QVision 150

Color Monitor is manufactured for Compaq by Zenith Data Systems; in fact, it is manufactured by Zenith Electric Corp. Additionally, the monitor consumes 115 watts of power (not the reported 173 watts) and does have an autosensing power supply.

In our First Look of Paradox for Windows (March 16, 1993), the fact file incorrectly stated that the database program works with Microsoft Windows, Version 3.0 or later. Paradox for Windows works only with Windows 3.1.

Regarding our November 10, 1992, review of networking hubs ("Empire Builders: 6 Enterprise Hubs"), several factual errors appeared in the review of Lannet Data Communications' MultiNet LET-36. The Lannet product does have STP Token-Ring modules; it supports single-mode fiber Ethernet; all modules allow individual port control and reconfiguration; and although we said you can install a server on the hub, in fact you cannot.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments and suggestions. Please send correspondence to Letters, *PC Magazine*, One Park Ave., New York, NY 10016-5802, or upload it to PC MagNet (see page 12 for access information). All letters become the property of *PC Magazine* and are subject to editing.

**386SL CONTENDA
PACKAGE I:**

\$1495

- CPU: Intel 386SL
- Processor Speed: 25MHz
- Memory: 2MB expandable to 10MB
- Hard Drive: 80MB
- Display: VGA backlit, 640x480, .23mm dot pitch, 256K video RAM, Sharp 7.4" diagonal, up to 64 shades of gray
- Battery: NiMH; operating time up to 4 hours; a snap to remove
- Size: 9.7" x 6.1"
- Weight: Only 3.9 lbs.
- Power Management: Fully featured, including Deturbo, Standby and Suspend to disk
- Keyboard: Comfortable 80-key with embedded numeric keypad
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All of pkg. II plus a nylon carrying case, extra battery, and internal 9600/2400 baud fax modem. The whole enchilada for less than \$2000!

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"...if you're looking for a subnotebook and want to make next to no compromises, then the \$1495 ZEOS Contenda is your best bet."

—PC Week, February 1, 1993

PC Week calls the ZEOS Contenda "the best yet of the new crop of lightweight, full-featured machines." We weren't satisfied with "best yet"—so we've made it *even better*. Because now you get your choice of a 386SL or 486SL CPU!

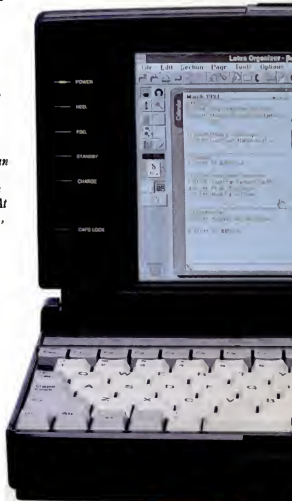
FEATURES THAT PULL NO PUNCHES.

Start by checking out the 386SL. The specs are on the left. It's impossible to find a notebook on the market today that's this light, this small, this affordable—and still gives you *so much power*. But it's all here.

For instance, there's the smart SL processor. According to PC Magazine, when it comes to notebooks, look for Intel's SL processor. The ZEOS Contenda's CPU extends your battery life significantly—because it's intelligent enough to power-down the memory, disks, modem and more when they're not in use.

What's more, its features make it a pleasure to use. Such as a crisp, vibrant VGA backlit screen. A built-in track ball. Enough power and memory to easily run Windows. And at less than 4 pounds in weight, it's probably lighter than your briefcase!

Smaller than a notebook, powerful as a desktop. At only 3.9 lbs., the ZEOS Contenda keeps you light on your feet.



Contenda:TM or 486SL CPU!

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IT COULD BE THE ONLY PC YOU'LL EVER NEED!

The 486SL gives you everything the 386SL version does, plus a few choice enhancements: 3.3 volt technology for added battery life, extra video RAM, PI local bus for Windows acceleration, and a high-speed floppy drive controller.

Take your pick. You'll find both Contendas give you the power and room for practically everything you'd use in a desktop system. You can easily run DOS, Windows and Windows applications. *And you can get all three—including the new Lotus Organizer—the personal information manager that's so easy to use, it could make your DayTimer obsolete.* Check out our upgrade packages for details. Then give us a call!

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Our relationship with you doesn't end once we ship your Contenda. ZEOS pioneered comprehensive customer support, and it's what keeps our customers coming back again and again. We back all of our products with Toll-Free Technical Support, 24 hours a day, 365 days a year.

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- CPU: Intel 486SL operating at 3.3v
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- Intel's PI local bus for video acceleration!
- Memory: 4MB operating at 3.3v
- Hard Drive: 80MB
- Display: VGA backlit, 640x480, .23mm dot pitch, Sharp 7.4" diagonal, up to 64 shades of gray
- 512K 3.3v video RAM
- Local bus video controller operating at 3.3v
- Battery: NiMH; operating time up to 5 hours with power management
- Size: 9.7" x 6.1"
- Weight: Only 3.9 lbs.
- Power Management: Fully featured, including DeTurbo, Standby and Suspend to disk
- Keyboard: Comfortable 80-key with embedded numeric keypad
- I/O Ports: 1 serial and 1 parallel standard; ports for optional internal modem, external 3.5" floppy and external color VGA or SVGA monitor
- Pointing Device: Easy-to-use trackball
- Warranties and Guarantees: ZEOS award-winning 24-Hour Toll-Free Technical Support, 30-Day Absolute Satisfaction Guarantee, complete Customer Satisfaction Package

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You get all of Pkg. I, plus external floppy, DOS, Windows and Lotus Organizer!

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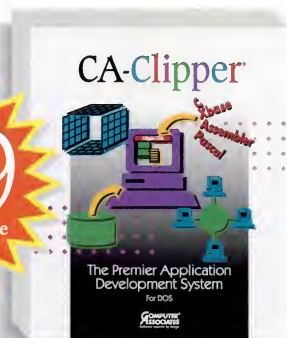
We upgrade Pkg. II to 8MB of RAM—and add a custom-fitted nylon carrying case, additional battery and fax/modem. Perfect for road warriors!

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The Complete, Professional Programming Environment For Xbase.

CA-Clipper™ 5.2 is a robust language, an efficient linker, a flexible pre-processor and a high-performance compiler. It includes: an editor, debugger and make utility, forming a comprehensive system for creating and distributing PC and LAN-based applications.

Faster Access, Faster Screen Writes, Faster Performance.

Address up to 32 megabytes of mem-

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dynamic overlays to let you exceed available RAM. You also get faster screen writes, thanks to RSIS compliance.

Feature	CA-Clipper	FoxPro	dBASE IV
Lexical Variable Scoping	YES	NO	NO
User-defined Commands	YES	NO	NO
Code Blocks	YES	NO	NO
Nested Multidimensional Arrays	YES	NO	NO
Predefined Object Classes	YES	NO	NO
Variables Modifiable in Debugger	YES	NO	NO
Customizable Reactive Error Handling	YES	NO	NO
Reads and Writes FoxPro (.CDX) Files	YES	YES	NO
Reads and Writes dBASE IV (.MDX) Files	YES	NO	YES
Reads and Writes Paradox (.DB) Files	YES	NO	NO

Comparison based on FoxPro Version 2.5 for DOS and dBASE IV Version 1.5.

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CIRCLE 344 ON READER SERVICE CARD

TV Wannabes

PC video to approach TV quality.

Playing motion-video clips on the PC is a great idea. But today's PC movies are often disappointing. Most of the time, they just don't look as good as television. Fortunately, several developments will enable vendors to deliver improved motion video soon. Better codecs (al-

gorithms that handle the compression and decompression), video-optimized hardware and software, and faster CPUs combined with local-bus system architectures will all bring PC video closer to TV quality.

Many variables affect the quality of video playback, including the quality and content of the captured image, the CPU and video subsystem, and the codec.

"The state of the art today for software-only playback is 320 by 240 pixels at 15 frames per second," says Steve Linowes, product manager of Microsoft's Video for Windows. "In the next six to twelve months," he says, "we should see that go up to 640 by 480 at 20 to 24 fps, and eventually to 30 fps," the frame rate of broadcast TV.

Microsoft's Video for Windows ships with three codecs—Intel's Indeo, and Microsoft's Video1 and Run Length Encoding (RLE)—all of which are being tweaked. Indeo, for example, can now capture 320 by 240 at 15 fps and has improved playback, which is limited to 160 by 120 at 15

fps. Other codecs are improving, too. Apple's QuickTime for Windows is expected to include the Compact Video codec, which can handle playback at 320 by 240 at up to 30 fps on a 33-MHz 486. And Iterated Systems is bringing its fractal compression technology for still images to motion video; its \$1,795 VideoBox developers' kit for DOS handles playback of 320 by 200 at 30 fps.

PC movies will soon be able to run in a wider variety of environments as a group of vendors that includes Microsoft and C-Cube Microsystems Corp. develop a standard file format for Motion-JPEG (not to be confused with MPEG—Motion JPEG is the video extension of the still-image JPEG technology). The new file format will become part of Video for Windows' AVI scheme.

Hardware is becoming more attuned to video. Graphics adapter-maker ATI Technologies has developed a suite of drivers that optimize the three codecs that ship with Video for

Windows for ATI's mach32 graphics chip. Just as Windows graphics accelerators work by speeding up functions frequently used by graphics (such as bitblts), ATI's Multimedia Video Acceleration drivers speed up functions frequently used by video (such as stretch-blits).

As capture boards get better and cheaper, the potential for better playback will grow. Intel's new \$699 Smart Video Recorder, for example, captures at 30 fps (but doesn't accelerate playback).

Finally, as more and more PCs use faster, more powerful CPUs (such as Intel's Pentium) and local-bus architectures (VESA's VL bus or Intel's PCI), motion-video playback on the PC will just get better and better.—Mary Kathleen Flynn

Next Year: DOSless Windows

ALTHOUGH MICROSOFT EXECUTIVES are focusing primarily on this year's operating systems—DOS 6.0 and Windows NT—some details about next year's DOS and Windows releases are beginning to emerge.

MS-DOS will continue to be improved as an end-user environment but not as a development environment, says Brad Chase, general manager, MS-DOS. "So 32-bit improvements for applications will come at the Windows level." DOS enhancements will focus on "conventional memory, utilities, portable computing, and taking further advantage of the 386 architecture—protected multitasking, for example." In addition, he says, "We may put things in MS-DOS that will help Windows apps run faster."

Code-named Chicago, the next version of Windows will not need DOS in order to run. Like Windows NT, it will have a lot of 32-bit code. According to Joe Krawczak, product manager for Windows, the next release "will borrow elements from Cairo." Microsoft's long-term project aimed at developing a more object-oriented interface that is more aware of distributed computing environments.

—Mary Kathleen Flynn



Pipeline By Robin Raskin

Springtime for Lotus

Maybe it's the Boston weather, but for the past three or four years, Lotus's seeds of new technology didn't take root. But now it appears to be springtime for Lotus. The recently announced flowers are Lotus Notes 3.0 and Lotus 1-2-3, Release 4.0, for Windows. Two others, Freelance Graphics for Windows and Lotus Improv, recently shipped, and a new Ami Pro for Windows (4.0) should soon be announced. Individually, each merits its own welcome.



Together they provide a set of apps that share common technology. Here are four areas to keep your eyes on: common code, Chronicle (codename for Lotus's version tracking), database replication, and multimedia.

While many vendors talk about sharing code between apps, Lotus makes good. Freelance, AmiPro, and 1-2-3 share a single speller and dictionary housed in a single

Lotus apps directory. SmartIcons, Status Bar, Dialog Editor, and Mail Enabling will also share the same code in the form of .DLLs.

Lotus's Chronicle technology was first discussed back in 1990. It's been slowly lumbering to life and will debut in 1-2-3 Release 4 as Version Manager. Created to take spreadsheet workgroup computing beyond file sharing, Version Manager allows you to assign a series of values or formulas to a spread-

sheet cell or range and then track and version those values. Explains Jeff Beir, vice president of the spreadsheet division, "People want to document their assumptions; work on the same model concurrently, tracking who made what changes when; get notifications; and do it in a secure environment." A single user might track personal versions of a spreadsheet; a networked group could use the file server to track and then consolidate disparate versions with a Merge.

The big win comes for 1-2-3 users who use Notes, too. The combination of Notes and 1-2-3 turns ranges into objects within the Notes database. Notes informs users as changes are posted to a worksheet. Since Notes databases can be replicated, or synchronized across multiple servers, you are guaranteed that up-to-date information is distributed throughout the system. With Chronicle and replication technologies in tandem, you can track versions across large groups. We expect to see Version Manager become part of all Lotus apps, not just spreadsheets.

Lotus is also revving up for a networked multimedia strategy. In the past year, products included Lotus Sound, Media Manager, and Annotator—mini apps that make multimedia creation and browsing easier. Ultimately, these mini apps will join the ranks of shared code; along with versioning and replication, multimedia messaging across the network becomes a natural.

Common code, Chronicle, replication, and multimedia are diverse but useful technologies that bring a breath of fresh air to the Lotus product line.

Robin Raskin is an executive editor of PC Magazine.

Color Lasers?

FROM THE DAY HEWLETT-PACKARD introduced the original LaserJet printer, PC users have dreamed of two things: the \$1,000 laser printer and the cheap color laser printer. The first dream has already been realized. This year, printer manufacturers will take the first steps toward making the second dream come true.

Color laser printers are already more than wishful thinking. But today's color lasers aren't exactly aimed at the ordinary user: They cost \$30,000 (and up) and have more in common with copying machines than they do with HP LaserJets. As Donald Park, executive vice president at printer maker QMS, explains, the color laser that PC users would buy would have all the advantages of a monochrome laser: 8-page-per-minute speed, desktop size, dependable print quality, quiet operation, and the ability to print on plain paper.

But while defining the ideal desktop color laser may be easy, producing it at a price PC users can afford is very tough indeed. According to A.J. Rogers, a strategic marketing manager at color printer manufacturer Tektronix, the challenges include

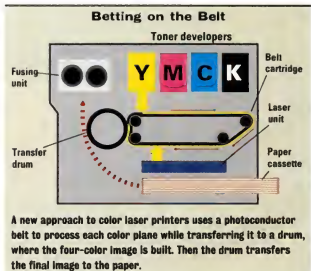
ghosting, uneven toner layers, color contamination, registration, and reliability.

A color laser printer is fundamentally more complex than a monochrome one because there must be four separate developers—one each for black, cyan, magenta, and yellow. There are currently two ways of approaching this problem: One method is to use a very large photoconductor drum with four separate passes. This is how copiers, such as Canon's CLC products, handle color. The other approach is to use four separate photoconductor systems.

Some companies are exploring using a photoconductor belt that processes each color plane while transferring it to a drum, where the four-color image is built. Then the drum transfers the final image to the paper. This method requires four imaging passes but only one transfer to paper. The advantages are smaller size and improved registration. Bill Flynn, an analyst at BIS Strategic Decisions, says this technique has promise.

Despite all the technical problems, color

lasers are expected to debut this year. The first machines will be expensive—around \$15,000—which will keep some players away. HP plans to wait until prices drop below \$10,000 to enter the market. HP and Lexmark International both say ink jets will solve most color printing needs.



A new approach to color laser printers uses a photoconductor belt to process each color plane while transferring it to a drum, where the four-color image is built. Then the drum transfers the final image to the paper.

By the mid 1990s, color lasers should cost around \$7,000. Will they ever get to that magical \$1,000 price point? "Not this decade," says Tektronix's Rogers.

—Mary Kathleen Flynn

Businesses Play War Games

FOR CENTURIES THE WORLD'S armies have used simulations to map battle campaigns before committing troops to war. Other professions incorporate simulations for training purposes when using the real thing is impractical or outrageously expensive. Flight simulators, for example, are used to instruct pilots in taking off and landing at a slew of airports and in whatever weather condition the instructor dials up. So it should come as no surprise to see a simulation that is being used to train business executives in running a business.

Top Retail Software

Current ranking	Last issue	Product/company
1	1	MS-DOS 6.0 Upgrade Kit Microsoft Corp.
2	13	WordPerfect 5.2 for Windows Upgrade Kit WordPerfect Corp.
3	12	WordPerfect 5.2 for Windows WordPerfect Corp.
4	—	Quicken 2.0 for Windows Intuit
5	6	Stacker 3.0 SAC Electronics
6	2	Microsoft Windows 3.1 Microsoft Corp.
7	4	QEMM-386 6.0 Quarterdeck Office Systems
8	—	Quicken 6.0 Intuit
9	—	WordPerfect 5.1 Upgrade Kit WordPerfect Corp.
10	7	Paradox for Windows Borland International Inc.
11	3	Lotus Improv for Windows Lotus Development Corp.
12	10	Quattro Pro for Windows Borland International Inc.
13	—	PrintCache 3.1 Laser Tools Corp.
14	8	Microsoft Windows 3.1 Upgrade Kit Microsoft Corp.
15	—	Money for Windows 2.0 Microsoft Corp.

This list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending April 3, 1993. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information compiled by Ingram-Micro.

The kicker is, the tool that's being used is a game. Maxis, the maker of SimCity, SimEarth, and SimLife, has opened a new division devoted to developing simulation games for business and government. The first business simulation was SimRefinery, which it developed for Chevron. SimRefinery teaches managers how to run a refinery. It allows them to define the products, raw materials, and operating conditions.

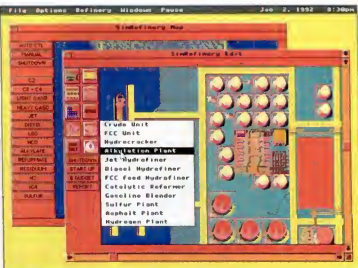
The simulation comes with a supporting text that walks the pupil through the refinery. SimCity and SimEarth users would feel comfortable exploring the property because it uses similar graphics. But unlike commercial games, the simulations don't have all the features enabled. It may look like a game, but only those aspects that actually teach the business are operational.

During the training session, the student manager of SimRefinery establishes goals by choosing the products the refinery will make, selects the crude oil to process, and controls how much raw material the refinery receives. Using proprietary terms and conditions the manager should be familiar with, the manager must choose the right components and recipes. If successful, the refinery will show a profit; if not, a loss.

After SimRefinery, Maxis created Sim-Environment, which lets companies measure how their moves affect the environment. On tap is a power-utility simulation being developed for the Energy Power Research Institute. The product will teach not only how to control a power grid but also how to develop power conservation and do long-range planning.

Because of the programming time required to customize a simulation, these games don't cost \$100. They are priced more in the \$50,000 and up range; Chevron paid \$75,000 for SimRefinery. The simulations fit into a company's traditional training structure as part of a curriculum.

According to Maxis, instead of providing specific hands-on technical expertise, business simulations are best used for crude overviews of entire systems. Targeted at vice presidents and middle managers who may have specialty knowl-



SimRefinery teaches managers how to run a refinery.

edge, the simulations allow them to work through big-picture issues.

—Christopher Barr

Finding Voters On CD-ROM

JOHN ARISTOTLE PHILLIPS, THE Princeton university student who gained fame in 1978 when he used readily available public documents to draw up the plans for an atomic bomb, is now selling CD-ROM disks that make it easier for anyone trying to publicize a cause, start a political movement, or run for office to get access to lists of registered voters.

Aristotle Industries makes two products that are changing the way constituencies get built (800-243-4401, 202-543-8345). Anyone who wants to pay 2 cents a name can get Democracy Discs, CD-ROM-based state-by-state lists of 118 million registered voters. The company also sells software that sorts the names into all kinds of special interests, such as retired Republicans from California who vote regularly. Another CD-ROM, called Fat Cats, lists 529,000 contributors to federal candidates, dating back to 1985.

Lance Copey, political director of the Maryland Republican Party, used CDs in the 1992 elections to generate phone call lists efficiently and inexpensively. "The CDs allowed us to get a really good response rate," he explains, "because we targeted only people who voted in the last three primaries and were therefore more likely to contribute to the campaign."

—Don Willmott

Caveat XA

DROVES OF USERS ARE BUYING CD-ROM drives, hoping to tap into the high-storage capacities (ideal for digitized video) that CD-ROM offers. Many, however, will be disappointed by the audio and video quality of CD-ROM software. The first level of a CD-ROM standard, MPC, was woefully underpowered. The next level you'll be hearing about, called CD-ROM XA, is arguably better than MPC but seems to be dying on the vine.

CD-ROM XA (eXtended Architecture) defines the way audio and video data can be written to (and eventually read from) a CD-ROM disk. There are two levels of XA compatibility: One defines the video storage component, the other adds compressed audio called ADPCM. The goal is to make it possible to play CDs with synchronized sound and pictures, rather than the poorly-dubbed-Hercules-movie-effect available under MPC now. XA does this by interleaving audio and video together into a single stream. When played back, the data stream is split into its different elements and presented simultaneously, and at a higher bandwidth than MPC.

The failure of XA has two causes: lack of XA hardware and a dearth of XA software. While some of the new high-end CD-ROM drives are XA-compatible and some current CD-ROM drives can be retrofitted with XA firmware, the bigger problem is software. Even with the stream of CD-ROM titles being rushed to market, very few are CD-ROM XA. And the few that are available, such as Newsweek Interactive, require specialized hardware, such as the Sony Multimedia Player.

Even though Microsoft (which spearheaded MPC) announced three years ago that it would support XA, the company has yet to release an XA CD-ROM title or to put XA support in an operating system. Only IBM has endorsed XA as a standard for its line of multimedia PCs, called the UltraMedia.

Like most emerging hardware platforms (such as pen computers), XA does not have a compelling killer application to lure buyers away from MPC. Kodak's Photo-CD will drive the short-term interest in XA because its present incarnation uses a version of XA for static images. A future version of Photo-CD will incorporate the audio aspects of XA. It may still be years, however, before XA really starts to catch on.

—Christopher Barr

PBX SUPPLIERS AT&T, NORTHERN TELECOM, and Siemens Rolm are helping Intel and Microsoft define Windows Telephony, which will integrate PCs and telephones. Other efforts to merge the technologies include Telephony Services (AT&T and Novell) and NotePhones (Siemens Rolm and Apple).

WOULD UNIX USERS RATHER SWITCH?

Thirty-seven percent of the 1,100 Unix-Forum attendees who participated in Dun & Bradstreet Software's opinion survey think Microsoft's Windows NT will offer benefits not yet provided by Unix.

THE PC PRICE WARS CLAIMED ANOTHER victim when direct marketer FastMicro closed its doors.

DATAPRODUCTS IS WORKING ON A Windows GDI printer. Expected to ship this

summer, the 8-page-per minute printer should cost around \$1,000. Other GDI-based printing products include Destiny's WinStyler controllers, LaserMaster's WinPrinters, and Microsoft's Windows Printing System.

ADAPTEC, LIKE NCR, IS DELIVERING A single-chip SCSI host adapter, which will make it easier to put SCSI on the system board. (Trends, April 27, 1993.)

POETS ARE USING PCs TO PUBLISH THEIR interactive works. Robert Kendall, a PC Magazine contributor, distributes Soft-Poems on disk (11 Willow St., Cranford, NJ 07016) and on CompuServe's LIT-FORUM. Rod Willmot publishes "Everglade," a hypertext poem, on disk (819-566-6296) and on the Digital Publishing BBS (205-854-1660).

—Mary Kathleen Flynn

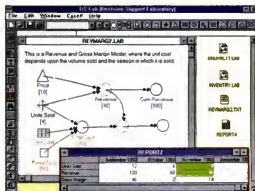
Spreadsheet Without Cells

SPREADSHEETS HAVE GOTTEN much easier to use over the last couple of years with such features as scenario managers, but the fundamental concept of rows and columns hasn't changed much. Lotus

Improv (which now runs on Windows), with its support for multidimensional modeling and natural-language descriptors, is probably the most intuitive one to date (First Looks, April 27, 1993). But this summer, a startup company called the DS Group will deliver a Windows spreadsheet whose interface is a radical departure from the rows and columns of the archetypal Lotus 1-2-3.

The DS Group's DS Lab is a spreadsheet without cells. Instead of filling in a matrix of cells, you create a flowchart that describes the relationship between, say, price, units

sold, and revenue. First, you draw the model (which can be edited) using tools from the toolbar. Then you define it mathematically, run the simulation, and finally report the results, which are stored in traditional spreadsheet formats such as Microsoft Excel's .XLS. You can print both the decision flowchart image and the traditional table. Initially, DS Lab will share information with other applications through Dynamic Link Libraries, but subsequent



Flowchart provides front end to spreadsheet data.

versions of DS Lab are expected to support Microsoft's Object Linking and Embedding (OLE) 2.0. The DS Group also has plans to support multidimensional modeling in a future release.

The product will come in two versions. The \$995 DS Lab Pro is aimed at financial analysts,

actuaries, and other professionals who develop large, complex models. The \$195 entry-level DS Lab is for occasional spreadsheet users who, the DS Group is betting, will be more comfortable with the flowchart interface than the traditional spreadsheet's rows and columns of cells.

—Mary Kathleen Flynn

57 IC



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A. Make sure you're getting more than just an OverDrive socket for your CPU. You want a computer

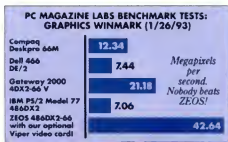
that you can *upgrade to Pentium-level technology*. With ZEOS upgradables, you're ready for the future...a Pentium future! And our Zero Insertion Force (ZIF) socket makes upgrading easy.

CPU upgradability is only part of the story. Check out the number of drive bays and open slots on the PC you want to buy. ZEOS gives you *six* bays, and eight slots—two of which are local bus!

Q. I want incredible speed. What should I look for?

A. For high-speed video that's upgradable with industry-standard graphic adapters, *you want a system that has VESA-standard local bus slots*. As we mentioned above, ZEOS gives you two of them. Our standard super-fast local bus SVGA card includes Windows acceleration, and if you want the video performance that PC Magazine said "blew all competitors away," choose our optional Viper video card. And, because you're getting the VESA standard, you won't get stuck with some proprietary architecture that's obsolete in 6 months. Demand

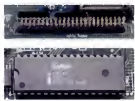
Demand



VESA standard with your system!

And for data transfer that's over twice as fast, get local bus IDE. It's the same fast local bus technology applied to the built-in IDE drive controller. ZEOS gives you performance *up to 225% that of ordinary IDE systems!*

Q. What's so important about SCSI? And Flash BIOS?



A. If you want to add high-performance CD-ROM drives and tape backups later, you need SCSI. ZEOS can add an extremely inexpensive (only \$49!) yet very high-performance SCSI option to your system without using an expansion slot. So you can run any SCSI options you desire—now or later.

Since optimum Pentium upgrades require changing the BIOS, we include FLASH ROM technology—so you can easily upgrade the BIOS through a diskette or modem.

Q. How do I know I'm getting a high-quality system?

A. Look for a *high-quality motherboard*. ZEOS designs its own motherboard. Other vendors offer their "motherboard du jour," changing boards every time they find a cheaper supplier. By controlling the manufacture of this key component, ZEOS guarantees you'll get full use of your PC far into the future.

Look for *quality components*.

Such as floppy drives by Teac. Thick, strong cases with reinforced steel. SVGA monitors with .28mm dot pitch that are non-interlaced all the way up to 1024x768 resolution. ZEOS gives you all of this—and more.

You want a system that can handle the speed that you demand. Today's high-performance CPUs can quickly turn into a space heater with a keyboard. Not with ZEOS. We ensure your system's long life with a few important extras: *a high-capacity power supply with built-in surge suppression, and twin cooling fans*. Because the cooler your system runs, the longer it will last.



Q. What other things should I look for when I buy a system?

A. First, UL Listing. Make sure it's on

More.

"This is a fast, beautifully designed PC with an upgrade path that just won't quit. That spells Best Buy to us."

—*PC World*,
2/93, Best Buy

"An array of features to make a user's mouth water."

—*PC Magazine*, 1/26/93

PC Computing "Kudos for its excellent motherboard design, great performance, and thoughtful little extras... These features set the ZEOS apart from the crowd."

—*PC/Computing*, 3/93,
Best Value

Forbes "ZEOS' engineering and quality advantages... clearly distinguish the ZEOS product from similarly priced machines."

—*Forbes*, 3/1/93



"The ZEOS is the fastest 33-MHz 486DX system we tested, and its performance even topped that of two 50-MHz 486DX2s."

—*PC World*, 2/93, Best Buy



"ZEOS's impressive new system grabs Windows by the throat and flings it across the screen with a sizzling new local bus graphics accelerator board parked in a local bus motherboard..."

—*PC Sources*, 4/93



"For a robust and upgradable high-performance system at an extremely competitive price, the ZEOS 486DX2-66 is an excellent choice."

—*Windows Magazine*, 5/93

"ZEOS's hot 486DX2 towers have Windows performance that will knock your socks off."

—Jim Seymour, *PC Sources*, 3/93



"The stand-out was the ZEOS 486DX2-66 system that blew all competitors away—in some cases performing more than ten times as fast as competitors."

—*PC Magazine*, 1/26/93

"ZEOS's thoughtful motherboard design—which includes a Pentium OverDrive-ready ZIF socket, plenty of space for full-height cards and an optional on-board SCSI interface—give it the advantage."

—*Windows Magazine*, 5/93

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486SX-33	1395	1895	2295	2595
486DX-33	1595	2095	2495	2795
486DX2-50	1695	2195	2595	2895
486DX2-66	1795	2295	2695	2995
Intel 486 CPU	■	■	■	■
ZIF upgrade socket	■	■	■	■
MB of RAM expandable to 64MB on motherboard	2	4	8	16
High-speed IDE hard drive (MB)	107	214	340	452
Built-in hard drive cache	32K	128K	128K	256K
Local bus IDE hard drive interface	■	■	■	■
Seek time (ms)	16	16	12	12
1.2MB Teac floppy drive	■	■	■	■
1.44MB Teac floppy drive	■	■	■	■
ZEOS 14" high-resolution mono VGA monitor	■	■	■	■
ZEOS 14" high-resolution 1024x768 non-interlaced SVGA monitor	■	■	■	■
Monitor dot pitch (mm)	.28	.28	.28	.28
1MB high-speed VESA local bus card with Windows accelerator	■	■	■	■
Eight expansion slots including two VESA local bus	■	■	■	■
Two serial ports, one parallel port	■	■	■	■
Shadow RAM/EMS support	■	■	■	■
Socket for optional on-board SCSI	■	■	■	■
Flash BIOS	■	■	■	■
High-capacity 200W power supply and built-in surge suppression	■	■	■	■
ZEOS SpaceSaver case with six drive bays	■	■	■	■
Two cooling fans	■	■	■	■
ZEOS 101-key tactile/click keyboard	■	■	■	■
Microsoft DOS 6.0 (plus enhanced tools)	■	■	■	■
Microsoft Windows	■	■	■	■
Microsoft Mouse	■	■	■	■
Choice of Lotus Improv, 1-2-3, Ami Pro or Freelance	■	■	■	■
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Advice

continued from page 4E

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 2. Arrow pointing to the fold
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Foldout slip-sheet



GbsSlipSheet-001

Inverted Foldout slip-sheet

Folded edge of the page

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2. Insert this sheet with

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4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



gbx5lipBack-001B

Back

1. Follow instructions on the other side

ZEOS[®]

the entire system, not just the power supply. It means your system has passed rigorous tests for safety and we think that it says something about quality, too.

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Advice continued on 5E



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Home Phone (____) _____ City _____ State _____ Zip _____
Soc. Sec. No. _____ Date of Birth _____ / ____ / ____ Employer _____ Since? (Mo./Yr.) _____
Address _____ Apt. _____ Monthly Gross Salary \$ _____ Daytime Bus. Phone (____) _____
City _____ State _____ Zip _____ Previous Employer _____ From _____ To _____
Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____ Occupation _____

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☐ **JOINT CREDIT** with another person. Complete entire application.

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.

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Relationship _____

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Checking Account <input type="checkbox"/> Yes <input type="checkbox"/> No	Dept Store Charge Card <input type="checkbox"/> Yes <input type="checkbox"/> No
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Y/N How Many?	Y/N How Many?
Bank Loan _____	MasterCard _____
VISA _____	Other Major Charge Cards _____
Finance Company Loan _____	

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Address _____ Apt. _____

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Bus. Phone (____) _____ Monthly Gross Salary \$ _____

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ZCD-PCM-9306A

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To try and compare the new ZEOS Freestyle/SL to any other notebook is next to impossible. Because nothing else has all its features. And even with all these great features, nobody can match its incredible new price. Features and price. It would seem the new ZEOS Freestyle/SL is the best of all worlds. It is.

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We listened well. Then we got down to work. For the chipset and CPU we selected the Intel 25MHz SL. We then built in a high-speed 64K SRAM cache as standard. We know this system might well replace a desktop for many users.

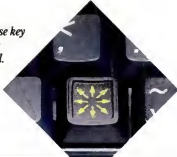
And power to your ZEOS Freestyle/SL system is provided by our advanced battery system. The fully enclosed lightweight battery packs easily snap in and out and can be "quick-charged" when the system is not being used, or trickle-charged when in use. So what happens when the power is on?



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CIRCLE 063 ON READER SERVICE CARD

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CIRCLE 073 ON READER SERVICE CARD

Circle 073 on Reader Service Card

First Looks

HANDS-ON EVALUATIONS OF THE NEWEST SHIPPING PRODUCTS

■ The Shape of Things to Come

Pentium Preview: Vendors Supply Five Prototypes

BY OLIVER RIST

Clamoring for your first Pentium? So was *PC Magazine*. Unwilling to wait until the processor's May 15 release date, we got our hands on five prototype Pentium-based systems.

Though the prices and performances are still unofficial (Intel embargoed our reporting specific test results before the chip's official debut), this early glimpse at PCs from ALR, Compaq, Digital, and Hewlett-Packard shows that a Pentium PC promises almost double the throughput of a 66-MHz

486DX2, but at a substantial price premium.

Initial tests show that a 66-MHz Pentium-based system has throughput between 1.8 and 2 times greater than a 66-MHz 486DX2-based system. These results were obtained using regular integer-based, not floating-point, code. New compilers, optimized for the Pentium's improved floating-point abilities, may show an even greater speed difference.

Our preview also helped us draw some general conclusions about what it takes to make Intel's new silicon soar. Fast

memory and secondary cache subsystems are essential in order to reap the benefits of this new technology. The fastest machines we saw used 128-bit paths to memory and 64-bit paths to the secondary cache. Advanced bus architectures and high-speed I/O subsystems will also play a large role in giving the Pentium a real workout.

As is often the case with new processor types, Pentium units are expected to be in short sup-



MAMMOTH: Evolution V's giant chassis.

ply initially. If you need the fastest PC available now and can afford the price premium, look for a system that uses the wide data path and advanced memory and cache architectures. Shop carefully.

Continues on page 38

■ Special Report

Gearing Up for 32-Bit Applications

BY CAROL LEVIN

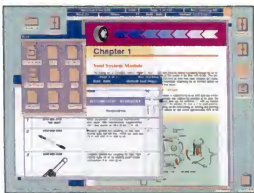
If you are wondering when Windows NT versions of the applications you run every day will be available, you are not alone. So are the developers! While there is a groundswell of support for Windows NT from software developers, most are waiting until NT is on the street to test for stability. This issue takes a look at Windows NT—Microsoft's new 32-bit operating system—but a quick survey of the apps landscape says not to expect much until three to six months after Windows NT ships.

The good news is that you

don't need the recommended 12MB of RAM, or even NT itself, to run the next generation of fast 32-bit programs. To lever-

aging interface (API) called Win32s, a subset of the larger Win32 API, that enables software makers to build 32-bit programs that run on top of 16-bit Windows (see the sidebar "Thinking: Running 32-bit Apps Without NT").

The big story here is performance, plain and simple. While some developers report speed increases of 100 percent over 16-bit programs, not all applications will benefit equally from being 32-bit. Spreadsheets and word processors show more modest speed improvements than graphics and computer-intensive applications.



32-BIT DTP: Interleaf for DOS, Unix, and NT.

age the existing corps of Windows 3.1 users, Microsoft developed an application pro-

Software development tools are expected to hit the market first. Borland C++ for Win32 and a 32-bit version of Microsoft Visual C++ are slated to ship within three months of NT. Symantec's compiler, Zortech C++ for Windows NT, has been available since February, and the Watcom C/C++ 32 compiler, which exploits the Pentium

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First Looks

Pentium

CONTINUED FROM PAGE 37

ALR Evolution V

ALR's vision of the perfect Pentium server entails upscale evolution: The Evolution V is a mammoth. It's almost wide enough to be called a double tower case, holds as many as 15 drives, and supports as much as a gigabyte of RAM. With memory and data paths wide enough to support the new chip, the Evolution V becomes an excellent file server with lightning-fast performance potential.

ALR has unveiled its new QuadFlex architecture for this model. A custom ASIC allows the Evolution V to send data from the CPU to the external cache along a 64-bit data path, and from the external write-back cache to memory along a 128-bit path. At this point this design supports a single processor, and ALR says there are no plans for the Evolution V to support dual Pentium processors.

The Evolution V's motherboard is gargantuan but provides plenty of upgrade potential in return. Amazingly, this system supports almost as much RAM as it does storage: 1GB if you fill all 16 memory sockets with PS/2-style, 64MB SIMMs. The system uses a 512K secondary cache and provides up to 1.2GB of SCSI hard disk storage.

The Evolution V contains ten 32-bit EISA expansion slots (six as bus masters) and three VESA local-bus slots. Though most file servers don't need it, the prototype we examined contained a VESA-compliant ATI local-bus video controller. ALR says the slots themselves add almost no cost to the system and may add functionality in the future, whether from video or a high-end drive controller. When the Fast EISA-2 specification is approved, ALR says the Evolution will be further upgraded in response.

Despite the roomy mother-

board, ALR placed the keyboard controller, serial, and parallel circuitry on an expansion card. Nevertheless, there are plenty of expansion slots left, and ALR said that this approach allows for overall smoother system performance.

ALR redesigned the Evolution V's outside, too. The case's flat-black color is attractive and modern, and the huge chassis allows for easy access to all system components. However, the motherboard and drive bays each need to be accessed from opposite sides of the case and neither side is on hinges; both need to be unscrewed. On the other hand, five internal fans ensure that your Pentium remains cool and collected, and the fault-tolerant 450-watt power supplies will help stave off disasters as well.

For the time being, ALR says the product will be supported by its standard, one-year parts-and-labor warranty with a \$9.95 service charge for on-site service.

The combination of a Pentium processor and ALR's QuadFlex architecture has the power to make the muscle-bound Evolution scream.

• List price: ALR Evolution V, with 16MB RAM, 1GB hard disk, SuperVGA video, price to be announced. Advanced Logic Research Inc., 9401 Jeronimo Rd., Irvine, CA 92718; 800-444-4257, 714-581-6770; fax, 714-581-9240.

Circle 420 on reader service card

ALR ProVEISA

ALR's upgradable ProVEISA has been described as an average, competitively priced, 486-based file server. But though the ProVEISA is certainly price-worthy, it's not cheap enough for its present users to throw it out and purchase ALR's new Evolution V, a system that's been



UPGRADE: Pentium extends ProVEISA:

owners happy, ALR has designed a Pentium processor upgrade module. The module requires both a proprietary slot and one standard ISA slot on the ProVEISA's ten-slot motherboard. The proprietary connection allows communication with the rest of the system, and the ISA connection powers and grounds the unit.

The upgrade module is packed with 512K of secondary cache, the clock crystal, and some discrete logic to help take advantage of the read/write-back memory features contained in the new processor.

Though its discrete-logic components should help a little, you'll still be running slower

optimized for the Pentium processor.

To keep today's ProVEISA

SUMMARY OF FEATURES

Pentium Systems

Products listed in alphabetical order

	ALR Evolution V
■ = YES □ = NO	
List price (16MB RAM, 1GB hard disk)	TBA
Case style	Tower
Bus architecture	EISA
Watts, number of connectors	450, 14
Motherboard and CPU	
Chip set manufacturer	ALR, Intel
Processor location	Motherboard
Processor-to-cache data path	64-bit
Cache-to-memory data path	128-bit
Flash memory BIOS upgrade	■
Memory and RAM Cache	
Installable RAM	4MB-1GB
External processor RAM cache	512K
Cache architecture	Direct-mapped
Cache write policy	Write-back
Disk Drives	
Front-accessible drive bays (5.25", 3.5")	13, 2
Internal drive bays (5.25", 3.5")	0, 0
Floppy disk drives	1, 44MB
Hard disk options	340MB-1.2GB
Disk controller location	ISA card
Expansion Bus	
16-bit, 32-bit slots	0, 10
VESA, PCI, proprietary local-bus slots	3, 0, 1
Parallel, serial, mouse ports	1, 2, 1
Video	
Display circuitry location	Local-bus card (optional)
Video chip set manufacturer	ATI
TBA-To be announced	

First Looks

than you would with true Pentium power, since the system has to funnel the processor's 64-bit path potential down into a 32-bit data bus.

The prototype upgrade board we examined had wires hanging all over it, but still auto-configured as promised and ran the 60-MHz Pentium without difficulty; you don't even have to run EISA configuration.

Like other systems in the ProVEISA line, a typical metal tower case (complete with U-shaped metal cover held in place by screws) provides a case lock and a front panel lock. The plastic door protects your power and reset switches from unwelcome or unskilled fingers. There's also

room for I2 drives, and the system sports two fans. To adjust to the blistering heat a Pentium generates, ALR covered the silicon with a heat sink and a dedicated processor fan. This fan is also hooked to a thermal sensor that measures the silicon's heat level and increases or decreases the fan speed in response.

The rest of the system stands as it always did: Eight 32-bit EISA expansion slots combine with two 16-bit ISA slots, up to 256MB of RAM, and a maximum of 535MB of hard disk storage. ATI's UltraPro EISA video board with 2MB of VRAM is hooked to a monitor capable of only 800-by-600 resolution.

ALR has promised numerous software upgrades designed to make the ProVEISA much more competitive as a file server. Improvements include fault prevention and tolerance features, as well as a serious upgrading to internal security.

ProVEISA users won't experience the chip's full power, since the system was originally designed as a 486. For full Pentium computing under the ALR flag, you need QuadFlex architecture; right now, that's only in the Evolution V. Still, the Pentium module will help ALR's existing ProVEISA customers extend the life of their computers.

• List price: *ALR ProVEISA*, with 16MB RAM, 1GB hard disk, \$6,000 to \$7,000. *Advanced Logic Research Inc.*, 9401 Jeronimo Rd., Irvine, CA 92718, 800-444-4257, 714-581-6770; fax, 714-581-9240.

Circle 421 on reader service card

processor and memory expansion slots are proprietary, with only the memory slot potentially crowding the processor. This minor flaw is rendered moot with the Pentium module, since that processor card is designed to hold all system memory up to 136MB.

Compaq's Tri-Flex architecture shows that the Deskpro was designed with Pentium in mind. Much touted in previous reviews, this architecture helped make the Deskpro/M a relatively pricey 486. Now, however, it's allowed Compaq to be the only vendor we've seen to fully implement a four-way 32-bit interleaved data path from memory to its Tri-Flex controller, for an effective throughput of 128 bits. From the Tri-Flex controller, data can speed to the Pentium on a true 64-bit data path and also to the external 256K cache (perched on the processor board as an optional daughtercard) at the same pace. The cache also talks directly to the Pentium, again at 64 bits.

Taking a cue from the Pentium, which supports error-checking of the CPU's internal 16K cache, Compaq built in error-checking for the external cache as well.

Video provided Compaq's

Compaq Deskpro 5/66M

Compaq's news isn't so much about a system as it is about a processor upgrade board—but that's also what makes this implementation shine. Compaq didn't design a whole new system around the Pentium. It came out with a truly awesome upgrade board whose prototype outperformed just about everyone else's, even when plugged into a PC the user could already own.

Inside the Deskpro 5/66M's excellently finished case, the motherboard carries a separate section (containing system BIOS, I/O

ports, and Business Audio) that easily slides out for no-headache BIOS upgrades, plenty of VLSI circuitry, and six bus-mastering EISA expansion slots that can all hold full-length cards. The

usually excellent results—meaning its EISA-based QVision video card. This time, though, the card turned in consistent scores comparable to many local-bus

[Continues on page 40](#)



WINNER: Tri-Flex architecture pays off.

ALR ProVEISA	Compaq Deskpro 5/66M	DEC 560ST Pentium	HP NetServer LM
\$66,000-\$7,000	Under \$11,000	TBA	\$8,086
Tower	Desktop	Mini-tower	Tower
EISA	EISA	EISA	EISA
300.6	240.4	254.6	396.9
ALR, Intel	Compaq, LSI Logic, Motorola	Intel	Intel
CPU module	CPU module	CPU module	CPU module
64-bit	64-bit	64-bit	64-bit
32-bit	64-bit/128-bit	32-bit	32-bit
■	□	■	■
4MB-256MB	8MB-136MB	4MB-192MB	2MB-384MB
512K	256K	256K	256K
Direct-mapped	Direct-mapped	Two-way set-associative	Two-way set-associative
Write-back	Write-through	Write-back	Write-back
5, 0	3, 0	3, 1	8, 1
1, 6	0, 1	1, 0	0, 0
1.44MB	1.44MB	1.44MB	1.44MB
200MB-535MB	240MB-510MB	127MB-1.0GB	530MB-1.0GB
Motherboard	Motherboard	EISA card	EISA card
2, 8	0, 5	0, 6	0, 8
0, 0, 0	0, 0, 2	0, 0, 1	0, 0, 1
1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1
EISA card	EISA card	ISA card	Motherboard
ATI, Texas Instruments	Compaq	S3	Western Digital

First Looks

Pentium

CONTINUED FROM PAGE 39

designs, Compaq also sent us its new QVision 20-inch monitor. This is an excellent piece of equipment, with a brilliant flat screen managed by digital, front-mounted image controls. The low-emission monitor also features BNC-5 connectors and supports very high refresh rates—76 Hz at 1,024-by-768 resolution. Compaq is also introducing a QVision videocard that supports 1,280-by-1,024 resolution at equally high refresh rates and with comparable speed.

Compaq is also showing Pentium-based SystemPro and Deskpro/I products. Owners of the SystemPro XL will be able to plug in a new processor card, much like owners of present Deskpro/M 486-based models can, to get Pentium power. Though the SystemPro should support dual Pentium chips fairly soon, those interested in multiprocessing on a Deskpro will apparently have to wait until late 1993 or early 1994.

The Deskpro/I product is not based around a processor plug-in card, so customers interested in that model can plan on buying a new system.

- List price: *Compaq Deskpro 5/66M*, with 16MB RAM, 1GB hard disk, 20-inch QVision monitor, under \$11,000. *Compaq Computer Corp.*, P.O. Box 692000, Houston, TX 77269-2000; 800-345-1518, 713-370-0670; fax, 713-378-1443.

Circle 422 on reader service card

DEC 560ST Pentium

Like ALR, Digital Equipment Corp. has added a Pentium upgrade module to its ST series to augment a product line not

originally designed to support the chip. Instead, the DEC 560ST Pentium relies on Intel's XPress bus architecture to provide adequate performance—better than a 486, but perhaps not as fast as a system with wider data paths.

XPress provides only a 32-bit interface to memory and a 64-bit path to the secondary cache; by comparison, Compaq's Tri-Flex and ALR's QuadFlex architectures provide a 128-bit path to the cache, a 64-bit path to memory, and a 32-bit path to the rest of the data bus.

Even more surprising, XPress runs its memory bus at



XPRESS 64-bit data path suffices for now.

only half speed—33 MHz in the case of a 66-MHz Pentium. This may cause significant slowdowns on secondary cache misses.

On the other hand, adequate Pentium performance is all any server needs right now. With Pentium-optimized software still months away, networks will function just fine on an average Pentium for some time. And the 560ST will still blow the doors off a 486.

The rest of the ST is well configured for file server applications—particularly Novell's NetWare. The ST supports a maximum of 384MB of RAM (using 32MB SIMMs) and has a variety of hard disk options, from 127MB to a gigabyte. Its slightly smaller-than-average tower case is built like a tank, complete with radio-frequency shielding and solid case construct supports. A 300-watt power supply pumps juice to the unit,

and external security is left to two key locks and numerous software protectors.

The 560ST comes with a one-year parts-and-labor warranty, complete with on-site service.

- List price: *DEC 560ST Pentium*, with 16MB RAM, 1GB hard disk, SuperVGA display, price to be announced. *Digital Equipment Corp.*, Personal Computer Business Unit, 50 Nagog Park, Acton, MA 01720; 800-344-4825, 508-493-5111; fax, 800-234-2298.

Circle 423 on reader service card

HP NetServer LM

Hewlett-Packard decided not to attach the Vectra name to its first Pentium system. That's a fitting move, because the NetServer LM's hulking tower box bears no family resemblance to the rest of HP's PC-compatible line.

Almost square in appearance, the NetServer LM's case provides room for nine drives and a 396-watt power supply. We were a little disappointed by the lack of doors, but HP will provide thumbscrews on the panels for the shipping version.

Like Digital Equipment Corp., HP uses Intel's Xpress bus architecture. As a result, the



NEW NAME: HP's Pentium server abandons the Vectra label.

motherboard is a little disappointing. Though it does support EISA (with eight expansion slots plus one proprietary slot for the CPU module), the architecture opens only a 64-bit data path to memory, and it runs the memory bus at half speed (30

MHz for a 60-MHz Pentium; 33 MHz when the 66-MHz model ships).

On the bright side, company representatives say the NetServer should ship with the new Fast EISA specification, when the spec is approved in June. This enhancement will speed up the I/O bus, though it will not affect the memory.

For now the NetServer LM may be slower than some Pentium implementations, but it's certainly got the muscle to be a NetWare server. The NetServer takes a maximum of 256MB of RAM (or 348MB with special SIMM sticks), which can be changed to ECC memory as an option. The system works in conjunction with a 256K secondary cache.

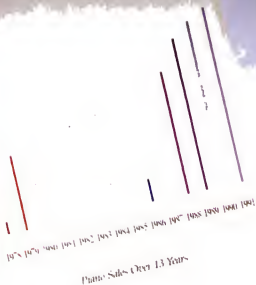
For storage, the NetServer LM includes internal SCSI and has an 8GB drive array option. HP hopes to complement this with an additional 10GB in an external array. Since these products aren't ready yet, the prototype unit we examined was configured with only an UltraStor controller and a pair of 535MB Seagate SCSI-2 hard disks.

HP's plans for the Pentium line are impressive. Dual-Pentium-capable units are coming soon, and the product will ship with a new three-year worldwide on-site service warranty. You'll also find Hewlett-Packard's NetServer Assistant server management software (an OpenView application) bundled, and the unit will be certified for any major NOS.

- List price: *HP NetServer LM*, with 60-MHz processor, 16MB of RAM, 1GB hard disk, SuperVGA display, \$8,086. *Hewlett-Packard Co.*, 3000 Hanover St., Palo Alto, CA 94304; 800-752-0900, 415-857-1501.

Circle 424 on reader service card

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Primera[™]
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CIRCLE 142 ON READER SERVICE CARD



First Looks

Windows NT

CONTINUED FROM PAGE 37

chip's ability to process multiple instructions at once, is now available.

WHAT'S IN IT FOR YOU?

Thirty-two bit technology is not really all that new, especially for developers of Unix and OS/2 software.

AimTech's Icon Author, for example, is a multimedia authoring tool that currently runs on Unix and Windows. The Win32s version in development will enable computer-based training applications to run faster.

Creative Systems Programming is bringing Golden Compass, an OS/2 communications program that automates access to CompuServe forums, libraries, and mail, over to NT. The new version will offer multithreading so users can download messages from one forum and simultaneously respond to messages from another forum.

Frame Technology's desktop publishing program, FrameMaker 3.0 for Windows NT, shows a 30 to 40 percent increase in performance over the current Windows version. Moving to NT is a natural transition for FrameMaker, which is already available as a 32-bit Unix application.

Great Plains Software's Dynamics, a new LAN accounting package for Windows and Macintosh, will be available in a 32-bit version for Windows 3.1. Benefits will include faster reports and faster posting. A later version will take advantage of NT's multithreading and preemptive (not just cooperative) multitasking.

Image-In, an early adopter of NT technology, expects NT to validate desktop color work, which has traditionally been slow and cumbersome. It reports that Image-In Color Professional for NT, a high-end image editing package, runs at twice the speed of the current Windows 3.1 version. This performance boost is due to NT's flat

memory model, which doesn't require an image to be paged through memory.

Interleaf's advanced electronic publishing system already runs in Unix environments and in extended 32-bit DOS environments. Prior to a full NT implementation that will exploit

Lotus Notes server that will take advantage of NT's symmetric multiprocessing. Lotus expects it to be available shortly after NT ships.

MathSoft's Mathcad 4.0 is now available with Win32s libraries that double the speed of this mathematical package.



IN THE WINGS: Faster 3-D rendering with 32-bit Typewright.

multithreading for intensive background computation, the forthcoming Windows 3.1 version will include Win32s dynamic link libraries (DLLs) so that users can develop their own 32-bit Interleaf applications.

Lotus is developing a 32-bit

allow manipulation of large vectors, and eliminate the 16-bit limit on array size.

Micrografx plans to migrate its entire line of graphics applications, including Designer, to 32-bit architecture. Since its programs do a lot of coordinate

transformations, early testing shows speed gains of at least 100 percent over 16-bit counterparts.

Microsoft's desktop applications—Excel, PowerPoint, Project, and Word—are slated for conversion to NT over the next year. Two of these programs should be available by year's end, the rest in 1994. Since they'll be full NT applications (not Win32s), you won't be able to run them in 32-bit mode under Windows 3.1.

Pioneer Software's Q+E for Windows NT, a query and reporting tool for client server environments, will take advantage of true multitasking. Acting like two computers running at once, your machine won't lock up when chewing on a database query that takes 10 minutes.

Pixar, maker of advanced 3-D rendering software, originally developed the CPU-intensive Renderman in 32-bit mode for Unix and plans to make it available for Windows 3.1 and Windows NT. It also expects to make Typewright, a program that renders 3-D pictures from type. The real benefits will show up under NT, though, where multithreading will enable you to render an image in the background without tying up your machine.

■ "Thunking": Running 32-bit Apps Without NT

The next software upgrade you buy may be a speedy 32-bit program that runs in Windows 3.1, a major beneficiary of Windows NT technology. Microsoft has developed an enabling technology called Win32s that gives software makers the ability to build a single 32-bit application that works on both existing Windows 3.1 desktops and on Windows NT.

Win32s is part of Microsoft's strategy to deploy 32-bit applications quickly without making users wait for their organizations to convert to NT.

Win32s is a subset of the full-blown Win32 API (application programming interface) that's used to build Windows NT applications.

Included in Microsoft's Software Development Kit for Windows NT, Win32s is a set of dynamic link libraries (DLLs) and virtual device drivers (VxDs) that run 32-bit applications in 16-bit Windows. The 32-bit calls are converted, or thunked, from a flat 386 memory address module down to a segmented 16-bit model. Think of it as shifting your car into a lower gear.

Microsoft says, however, that applications developed specifically for Windows NT will benefit from optimal speed gains. Also, server applications, such as communication gateways and database servers, will need the extra power of multithreading and security that only the full-blown Win32 API provides.

Win32s Conceptual Architecture



Source: Microsoft

Beauty And dBASE.



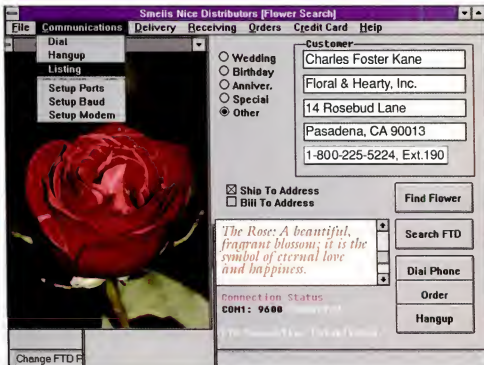
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CA-dBFast 2.0 also includes CA-RET — an outstanding Windows-based report writer that lets you mix text, graphics and data on the same report in a full WYSIWYG environment.

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CIRCLE 400 ON READER SERVICE CARD

Input Devices

Microsoft Mouse Gets New Look and Feel

BY MARY KATHLEEN FLYNN

Microsoft has revamped the best-selling alternate input device in the world, proving that a product doesn't have to be broken to get fixed. The \$109 Microsoft Mouse 2.0 is larger, longer, and higher than the classic Microsoft Mouse, making it more comfortable for more people to use. And now new Mouse Manager software makes navigating through Windows easier.

To design the new mouse, Microsoft studied the ergonomics of input devices, including extensive usability testing conducted by the Metaphase Design Group and the University of Illinois Department of Kinesiology. This research led to more support for the palm, bigger buttons, a shorter

versity of Illinois Department of Kinesiology. This research led to more support for the palm, bigger buttons, a shorter



VISUAL CUE: Soap-bar look is gone.

cable, more accurate cursor placement, and a smoother look and feel.

The new mouse definitely looks and feels different from the old one. The plastic feels smoother and looks shinier. The shape is different, too; bearing resemblance to an elongated apostrophe or comma. While Microsoft concedes that the new shape is "visually cued for right-handed people," the company insists it is "ergo-

nomically correct for either right- or left-handed use." Only 10 percent of the population is left-handed, and most left-handed PC users hold the mouse in their right hand, but a couple of left-handed *PC Magazine* editors were still put off by the shape.

Most users, however, will agree that the new Mouse Manager software makes it easier to use Windows. The customizable software features include Orientation, which lets you hold the mouse at any angle; Snap To, which jumps the cursor to the default button in a dialog box; Screen Wrap, which, when the cursor reaches the screen's edge, sends it to the other side; Locate, which lets you find the cursor easily by moving it to the screen's center; and Magnify, which lets you zoom in on a screen area.

The most potentially useful feature is Snap To. Unfortunately, it doesn't work very consistently within applications. In Microsoft Excel, for example, if you bring up the File Open dialog box, the cursor will snap to the default button—because the button is an object. But in the Format Numbers dialog box, the cursor won't snap to anything, because the button is just a drawn image. Over time, Microsoft hopes to expand the types of dialog boxes Snap To will support.

For the foreseeable future, Microsoft will sell both the old mouse (also for \$109) and the new one, but expects most customers (including PC manufacturers with systems) to choose the new design.

• List price: *Microsoft Mouse, Version 2.0, serial version, \$109; mouse port (PS/2) version, \$109; bus version, \$125; combination version (Mouse Port and Serial), \$125; combination with Microsoft Windows, \$225; five pack, \$499.* Requires: DOS 2.0 or later. *Microsoft Corp. One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080.*

Circle 429 on reader service card

Video Boards

SuperMac's Spectrum/24: Snappy 24-bit Color for \$999

BY BEN MYERS

High-resolution, true-color video has never been this cheap. SuperMac Technology's \$999 Spectrum/24 graphics adapter gives digital photography buffs and graphic artists who work with programs like Aldus Photo-Style, Adobe Photoshop, and CorelDRAW responsive 24-bit video performance at an unprecedented price point.

The Spectrum/24 comes only with 24-bit drivers for the Microsoft Windows environment. The board connects to your current VGA adapter via a short pass-through cable supplied by SuperMac that works with either of the two styles of feature connectors found on VGA cards. There's also an optional \$89.99 snap-on VGA module that lets you use the Spectrum/24 as a single-slot graphics solution. Its installation is simple.

RGB coaxial and 15-pin

monitor cables also come with the board to connect it to the most popular types of monitors on the market today.

The Spectrum/24's Resolution Picker utility allows you to choose from various SuperMac and NEC monitor types, or from custom combinations of various resolutions and refresh rates ranging from 640-by-480 up to 1,152-by-900.

In testing, we found that our Windows screen sometimes came up either off-center or sized incorrectly because monitor timing frequencies are not yet standardized. When this happened, we had to rely on monitor switches or choose another refresh rate for the same resolution to calibrate the size and shape of the on-screen image. SuperMac should add its own Windows utility to handle this adjustment better.

Though the Spectrum/24 runs only in 24-bit mode, it turned in an outstanding Graph-

ics Winmark of 8.4 in PC Labs' benchmark testing. Performance is fine for more mainstream, less color-intensive business applications such as word processing, too.

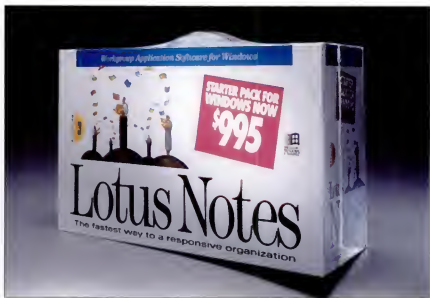
The full-length card is equipped with 3MB of 80-nanosecond VRAM memory, enough to handle high resolutions such as 1,152-by-900 because each pixel of color takes up exactly 24 bits in its memory layout. We tested an EISA version of the board, but SuperMac also has an ISA-bus version and will be shipping a VL-bus version soon.

If the editing and manipulation of 24-bit color images is important in your job, your best bet is to get the model of the Spectrum/24 that matches the fastest PC you use. Then sit back and watch fast 24-bit screen redraws and remind yourself how little you paid to get them.

• List price: *Spectrum/24, \$999 (EISA, ISA, or VL-bus models); snap-in VGA module, \$89.99.* SuperMac Technology, 85 Poirero Ave., Sunnyvale, CA 94086; 800-541-7680, 408-773-4498.

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Lotus Notes

■ DOS Utilities

Norton 7.0 Adds New Diagnostics, Supports DOS 6.0

BY EDWARD MENDELSON

Version 7.0 of The Norton Utilities is good news because it's no news. Symantec Corp.'s \$179 package remains the most advanced, reliable, and widely compatible set of disk utilities on the market. Except for a new hardware diagnostics utility and a floppy disk-duplicating program, you won't find any big surprises.

Improved versions of well-established utilities include the Norton Disk Doctor, which remains the best disk-repair program on the market; Disk Editor, which now lets you manipulate disk structures more easily and thoroughly than any other utility; and FileFind, which now replaces text strings in addition to searching them. NDOS, a compact and flexible COMMAND.COM replacement, has enhanced commands and setup and is better integrated with the package. (NDOS is a licensed version of JP Software's 4DOS, Version 4.02.)

You also get Norton's familiar disk cache, defragmenter, low-level disk formatter, file-repair utility, disk formatter, directory sorter, unerase, and system information programs. Veteran Norton users get enhanced versions of Norton's classic command-line file-management utilities. One TSR monitors disk activity; another automatically encrypts files when you save them. Norton's familiar batch file enhancer and control panel are unchanged.

DOS 6.0 COMPATIBLE

The new version adds full compatibility with DOS 6.0's DoubleSpace, Stack, and SuperStor compressed drives.

When working with compressed drives, the Norton Disk Doctor repair program checks compression structures during its disk-surface test, and the defragmenter uses a two-pass method to reorganize data within the compressed drive for fast access.

Norton now uses a virtual memory scheme that lets it han-

Norton's cache remains the fastest, most compact, and trouble-free disk cache available. Symantec now offers a separate \$99 version, with added CD-ROM support and a Windows-based configuration program, under the name Speedcache+. An upgrade for The Norton Utilities owners costs \$19, but the Speedcache+ version takes up more RAM, and you may be better off with the smaller version in the full Norton package.

DISASTER RECOVERY

No other utilities set does more to smooth the way to disaster recovery. If your hard disk won't boot, you don't need to find a floppy disk with DOS on it, because a bootable emergency disk in the package includes the Disk Doctor, Unerase, Unformat, and disk editor programs.

In case of physical damage, Norton's Disk Editor now includes a unique Advanced Recovery Mode. If the damage is so severe that you can access only the physical sectors on the disk, but not the logical structure that divides the disk into partitions and clusters, Disk Editor generates a "virtual structure" that works as if the logical structure survived. This virtual structure exists only in memory unless you choose to write it to the disk, so you can recover files without risking further damage by writing a new logical structure over the original.

Other changes match features introduced in PC Tools, Version 8.0 (First Looks, December 22, 1992). The Change Directory program now displays filenames while you manage the directory structure, the defragmenter lists the files in each cluster, and the disk editor includes a programmer's calculator. In addition, the file-repair program now revives damaged WordPerfect; Lotus 1-2-3, Release 3.0; and Excel 4.0 files.

A few glitches cause minor inconvenience but no danger. The install program asks for disks 2 and 3, but the disk labels are unnumbered. If you use the built-in option to change from long names such as DISKEDIT to short names such as DE, the program that creates the emergency rescue disk won't find the programs with short names. You can add the programs manually, or you can edit the undocumented, RESCUE.INI file to add the short-named programs automatically.

The Norton Utilities sells for the same \$179 price as PC Tools, but doesn't have the backup, antivirus, and file-management utilities that PC Tools includes. Symantec offers all these separately, and doesn't have network utilities like those in PC Tools. Norton's advantages are in its compatibility and disaster recovery. You get more for your money with PC Tools, but you get more safety with Norton. □

FACT FILE


The Norton Utilities, Version 7.0

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014;
800-441-7234, 408-252-3570;
fax, 408-253-4092

List price: \$179, upgrade \$49

Requires: 640K RAM, 1MB hard disk space, DOS 3.3 or later.

In short: Version 7.0 of the classic disk utility collection includes full DOS 6.0 compatibility and new hardware diagnostic tools.

 ON READER SERVICE CARD

dle large disks and directory structures that make rival packages fail. Norton had no trouble with a 1.2GB SCSI disk in one test system; the same disk caused the DiskFix program in Central Point's PC Tools to lock up and caused DiskFix in PC Tools for Windows to issue an erroneous message that the disk's partition table was corrupted.

The new hardware diagnostics program includes tests normally found only in specialized packages. It automatically surveys conventional, extended, and expanded memory, floppy and hard disks, and serial and parallel ports, as well as video, mouse, speaker, keyboard, and many system board functions.



DISK MAP: Norton displays maps of disks and files.



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W. J. J. J.

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LMNOPQRSTUVWXYZ
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*0+?

This font "TFHabitat" was created in Fontographer by Joe Treacy of Treacyfaces, Inc.



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■ Palmtop Computers

HP 100LX Adds Remote E-Mail

BY RICK AYRE

With so many rumors circulating about the future of personal digital assistants and handheld computers, it's easy to forget that Hewlett-Packard Co. has already sold thousands of its HP 95LX palmtops. The radically improved \$749 HP 100LX can only strengthen HP's dominance in the field of truly portable computing.

HP calls the 100LX a personal information appliance (PIA) because it enables a powerful kind of mobile computing. The 100LX has cc:Mail Remote electronic mail built in and the potential to be everything from a SkyTel pager to a wireless e-mail gateway.

While its 11-ounce weight and 1- by 6.3- by 3.4-inch (HWD) size makes it small enough for a jacket pocket, the 100LX is a full-screen (80 columns by 25 lines), fully functioning DOS 5-based PC, with 2MB of applications in ROM and 1MB of space to store database files. All this is powered by two AA-size batteries.

No matter what HP calls the 100LX, it's clear that the product goes far beyond the 95LX in features. Hardware improvements begin with the new 80-by-25 screen resolution. The improvements continue with PCMCIA 2.0 support, an improved 9-pin serial port (still nonstandard but more functional), and a better keyboard layout (though the keys are still the same small size).

What's most interesting

about the HP 100LX is all the software stuffed in ROM. The old applications work better, and the new ones add important functionality.

PERSONAL INFO MANAGER

What used to be a very limited address book has turned into a full-featured personal information manager. At its center is an appointment book that's easy to use (all the applications benefit from a new CUA- (common-user access) compliant interface. A simple function-key press switches you from a daily to a weekly to a monthly to a six-month view of your schedule. The address book has an integrated to-do list, space for appointment notes, and a full-text search tool.

Also improved is the Comm Manager, now called the DataComm Manager. What was barely functional before is now fully featured. It supports throughput up to 115,200 bits

you set up definition files to save settings for your different communications needs, and the program comes with definition files for popular e-mail services.

CONNECTIVITY PACK OPTION

If you need more connectivity, you'll probably be interested in the optional Connectivity Pack (\$119.95), which provides an easy way to share data between your palmtop and your desktop

process, but it lets you download e-mail header files only and mark the messages you want to download. cc:Mail Remote also lets you access your e-mail server interactively, and that means you can access cc:Mail bulletin boards from your 100LX.

Rounding out the software is Lotus 1-2-3, Release 2.4, and the brand new memo editor includes an outliner and text formatting. There is a Rolodex-style phone book and a similarly styled flat-file database. You'll also find an HP financial calculator, a stopwatch, and an application that tells you what time it is anywhere in the world.

All of these applications are one keystroke away. You switch from one to another without shutting down the open application. Using HP's "instant-on" functionality, the 100LX automatically saves your data every time you switch. The keys for the applications are clearly labeled with icons that make sense and are easy to find.

On the down side, the keyboard is still small for real typing; you won't do real word processing on a 100LX. The parentheses keys are now shifted keys located just about where they should be, but important keys, such as the forward slash, are still hard to find.

The LCD screen is clear and crisp, though not bright. The new 80-by-25 resolution results in characters that are small enough to make some users squint. A convenient zoom feature gives you the option of using the old CGA resolution or a new 40-by-16 mode, which results in the largest characters.

The HP 100LX is a compelling way to take just enough computing power on the road, especially if you need to communicate back to a LAN. With options such as modems and hard disk-like flashcards now available on PCMCIA cards, the 100LX is a more scalable solution than the 95LXone, and it can be better customized to your needs. □

FACT FILE

HP 100LX

Hewlett-Packard Co., 1000 NE Circle Blvd., Corvallis, OR 97330; 800-443-1254, 503-757-2004; fax, 503-750-5488

List price: \$749.

In short: The HP 100LX improves on the HP 95LX by adding better screen resolution, a PCMCIA slot, and cc:Mail Remote software.

ON READER SERVICE CARD.



SMALL WONDER: The HP 100LX is a great tool for communicating from the road.

per second and file transfer protocols that range from Kermit to X-, Y-, and Zmodem. The DataComm Manager lets

PC. It comes with a serial cable, file transfer software, DOS redirector software, and PC versions of the appointment book, phone book, memo editor, filer, and calculator. Using these tools, you can create or update databases on your desktop PC (with its full-size keyboard) and have up-to-date data in your pocket when you hit the road.

HAND-HELD CC:MAIL

HP and Lotus Development Corp. have a lot to say about the cc:Mail Remote software built into ROM. It's actually better than the cc:Mail Remote you buy for your laptop. Using it, you can compose messages off-line and then call and upload them to your networked cc:Mail server. Not only does the software let you send and receive e-mail in a batch

■ Voice Recognition

Listen for Windows Lets Your PC Understand What You Say

BY JOHN R. QUAIN

PCs are better than typewriters, but you still have to face the keyboard. Verbox Voice Systems' Listen for Windows, the latest PC-based voice recognition package, won't remove the QWERTY keyboard from your life, but you may never have to use a mouse again.

Intended for navigation, command, and basic data-entry tasks, Listen for Windows uses a speaker-dependent design rather than a speaker-independent approach. The latter uses general phonetic or linguistic rules for voice recognition. Listen compares spoken sounds to proprietary audio files it has been trained to recognize by the user. Also referred to as language-independent, Listen's approach means that anyone, regardless of diction or accent, can control their PC using spoken commands.

The basic \$695 Listen for Windows Power User's kit includes the Listen software and Speech Commander, an 8-bit ISA sound recognition card, and a headset microphone. On the back of the card there's a VGA-type connector for the microphone, a volume control, and monaural minijacks for audio input and output.

Installing the Speech Commander board is straightforward. It even works with sound cards like Microsoft's Windows Sound System installed. If you do encounter conflicts with other peripherals, jumpers and DIP switches on the card give you enough options to resolve them. On the board, two processors, a Texas Instruments 32-bit TMS 320C31 DSP and an 80C188 control processor, manage the calculations for recog-

nizing words and phrases. This alleviates the necessity for a fast PC, allowing Listen for Windows to work equally well on a slow 386SX or a fast 486DX PC.

The software includes voice-command files for the basic Windows desktop, as well as for the Calendar, Calculator, File Manager, Cardfile, and Microsoft Word for Windows. In WinWord, you can edit, indent, change fonts, print, and repaginate without touching the keyboard. Developers can also create context-sensitive speech applications.

Listen for Windows can handle about 300 active words (depending on the length of the words) and 420 word instances (which are similar to word combinations) per application. This is a larger vocabulary than the 42 active words in the Voice Pilot used in the Microsoft Windows Sound System. For more sophis-

BASIC VOICE TRAINING

Unlike discrete speech systems, Verbox's continuous speech recognition lets you speak naturally, even if you slur words together. The disadvantage of Verbox's speaker-dependent continuous speech recognizer is that you need to spend more time training the program. During training, you follow on-screen instructions, repeating words and phrases into the microphone until the program learns to match your instructions with the software commands. Getting a set of application-specific commands running smoothly, such as the 450 words and phrases provided for the basic Windows desktop, takes about an hour.

One of the major benefits of this approach is that, unlike discrete speech designs, you don't need to retrain the system for each separate expression. Listen for Windows' underlying grammar lets you string words together in different combinations, even though Listen was not trained to understand the particular phrase. Once the system has been trained to respond to "move down" and the numbers one through nine, for example, it will also recognize commands such as "move down one," "move down two," and so on. The notational grammar does have limits, however. You're restricted to voice commands of no longer than 24 seconds.

TALKING TO WINDOWS

In testing, the over-the-ear microphone was comfortable. Background noise, whether an FM radio or city traffic, doesn't impede its effectiveness. After a

single training session, most commands work without a hitch. In case you forget a voice command, a Listen window displays the words and phrases available in the active application, while a tiny window displays the last command that was recognized.

New users, however, will discover that controlling Listen takes practice. Because it records your particular speech patterns, it can be fussy. If you speak differently later—for example, faster or more slowly—it occasionally won't respond. If you really run into trouble, you can retrain the program.



SPEAK UP: Listen for Windows includes a headset microphone.

FACT FILE

Listen For Windows, Version 1.0

Verbox Voice Systems Inc.,
1090 King Georges Post Rd.,
Bldg. 107, Edison, NJ 08837;
800-275-8729, 908-225-5225;
fax, 908-225-7764

List price: \$695.

Requires: 8-bit ISA slot, 1.5MB hard disk space, Windows 3.1.

In short: Listen for Windows is a continuous voice recognition package that is trained to individual voices. Developers can use the included software to create custom voice data input apps.



ON READER SERVICE CARD

ticated applications requiring 1,000 active words and 2,410 word instances, 1MB of fast SRAM is available for \$1,000.

Generally, normal conversation will not trigger unintended commands, although verbal typos can still occur. "15" and "50," can confuse the program, and phrases like "I'll have to look it up," can trigger commands like "edit cut." To reduce miscues, the program's sensitivity can be adjusted using a sliding bar control.

Verbox has been building vertical voice recognition applications for seven years, and the company's experience shows. Listen for Windows is the first practical—and practically priced—voice recognition system for business PC users. But it isn't perfect. So don't expect carpal tunnel syndrome to be supplanted by laryngitis anytime soon. □

■ Multimedia Authoring Software

Create High-End Training Tools with Authorware 2.0

BY ALFRED POOR

When we selected Authorware Professional for Windows, Version 1.0, as the Editors' Choice in our March 31, 1992, evaluation of multimedia authoring software, we pointed out its industrial-strength feature set and said that mastering the program would take a sizable investment of time and effort. Version 2.0 has even more features, but fortunately, the package has become a bit easier to learn and use.

Authorware is a high-end, \$4,995 authoring tool with which you develop learning and training applications using Windows multimedia features (including graphics, animation, and sound). It has been used to create everything from K-12 math and reading programs to training programs for McDonald's employees to training personnel for airline security personnel.

BUILDING ICON FLOWCHARTS

This Windows program relies on a visual flowchart metaphor for creating applications. There are just 12 icons, which you drag into the workspace to construct logic structures.

After inserting an icon into the structural diagram, you can edit its attributes. The program also includes drawing tools so you can create or annotate an image (.BMP, .DIB, EPS, .PCX, .PCT, .RLE, and .WMF formats are accepted). You can also define the colors for objects, the special effects used to make them appear (and disappear), and even their display modes, which determine what portion of background will show through.

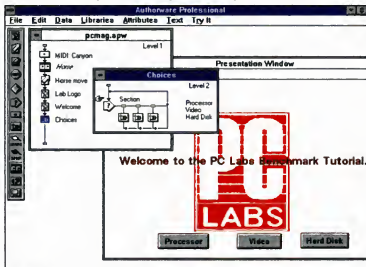
Icons for branching, either as a result of calculations, user input, or just random selection, are available. A calculation icon can be used to track user scores, trigger events, or use any one of hundreds of defined functions. A "wait" icon can be used to pause the application until the user responds or until a certain amount of time has elapsed.

The workspace has no scroll bars, so if your logic structure gets too big, it won't fit on-screen. This only encourages you to use the Authorware "map" icons, which serve as place holders for a collection of icons. This feature is somewhat analogous to a subroutine in programming. When you double-click on a map icon, it opens another workspace where you can edit its components. Map

video. Authorware directly supports both .PCM and .WAV sound-file formats and has custom functions available that support MIDI (Musical Instrument Digital Interface) files and audio CD through the Windows MCI (Media Control Interface).

The program supports a large number of movie file formats, including Autodesk Animator, .FLC, .FLI, and .CEL. Version 2.0 adds support for Macromedia Director files in the .MMM format. It also adds support for Microsoft Video for Windows (.MOV) files. These last two formats give access to full-motion, digitized video images for your applications. The program supports start-and-stop frames, as well as playback rate. There are also features that support external video playback devices such as laser disks.

Authorware now includes more sophisticated text-handling and interactive-response features. In Version 1.0, you could get user responses through items such as push buttons and free-form text answers. Version 2.0 adds sophisticated options that include irregularly shaped "hot" spots on-screen, as well as



APP BUILDER: Authorware uses multiple windows as workspaces.

icons can be nested, so you can keep your application segments small and manageable.

The program also has icons for multimedia functions, including sound, animated movies, and

a series of system variables for text handling that make it possible to create hypertext links.

Macromedia has added features to Version 2.0 that make it easier to create and manage

FACT FILE

Authorware Professional for Windows, Version 2.0

Macromedia Inc., 600 Townsend St., San Francisco, CA 94103; 800-288-4797, 415-252-2000; fax 415-626-0554

List price: \$4,995.

Requires: 2MB RAM (4MB recommended), 40MB hard disk space, Microsoft Windows 3.0 or later.

In short: Expensive but powerful, Authorware Professional for Windows continues to provide the tools that help you put Windows multimedia features in computer-based training applications.

ON READER SERVICE CARD

complex projects. For example, you can predefine icon libraries, and that means you can create a collection of often-used items, such as a display icon for your company's logo or a map icon that performs a user log-on subroutine. A single application can call on elements from more than one library, which can reduce development time.

There are even new features that developers can use to maintain applications. A text search-and-replace feature can quickly locate and change occurrences of text on display screens in one step—a big timesaver.

The package includes a runtime version of the program. The standard license permits free distribution of the runtime either within the company that purchases the full package or outside, as long as the application is distributed free.

Though the price of Version 2.0 of Authorware has dropped considerably (to \$4,995 from \$8,000), it's still not cheap. It does indicate, however, that the program isn't called "Professional" for nothing. If you're looking to create high-level, computer-based training materials with multimedia features, Authorware is a serious product that gets the job done. □

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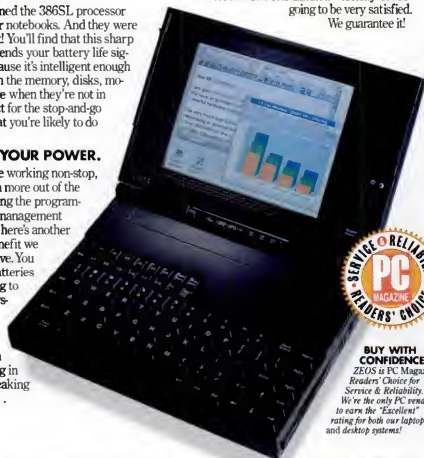
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CIRCLE 038 ON READER SERVICE CARD

■ Groupware

Lotus Notes 3.0: Improvements Target Applications Developers

BY DAVID DEJEAN AND
SALLY BLANNING DEJEAN

Users of Lotus Notes may think that the new Release 3.0 isn't much different from earlier releases, and they may not welcome the changes that they do see, like the arbitrary reordering of the command menus. But modifications like these are just on the surface. Deeper down, Lotus Development Corp. has made profound alterations to its client/server workgroup computing environment, changes that are mostly out of sight to end users but mean a great deal to the corporate developers and MIS departments, which comprise Notes' real market.

What these developers are after is Notes' ability to deploy and synchronize company infobases across a wide area network. Everything Notes manages—even electronic mail—is some form of a database, and all that data can be updated ("replicated") every time you log on. At first, Notes was priced to appeal only to large organizations, but with Release 3.0, Lotus is trying to broaden Notes'

acceptance. (For more information on the latest groupware technology, see "Groupware: Are We Ready?" in this issue.)

Release 3.0 of Notes (\$495 per node) delivers many things Notes customers have been asking for. Lotus has put special emphasis on multiplatform support (starting with support for both Macintosh clients and more network operating systems) and much beefier database management and application development.

Smaller organizations will also find that new server software based on Microsoft Windows (rather than OS/2), along with new pricing and distribution policies, will make it much easier to start small with Notes—as small as a server and two clients for \$995.

End users of earlier versions of Notes may find the least to like in Release 3.0. Obvious problems such as weak text formatting haven't been fixed, and new features like full-text searching aren't easy to use. The addition of Lotus's SmartIcons toolbar and changes to the command menu make the program

feel unfamiliar but not particularly improved.

MULTIPLATFORM AT LAST

The arrival of the long-promised Macintosh version (along with soon-to-come versions for several flavors of Unix) makes Notes a multiplatform product at last. While the prereleased Macintosh software we looked at was still unstable, it's clear that Notes for the Mac works just like the Windows and OS/2 versions, and in mixed environments, cross-platform communications and application sharing function well. (Macs aren't full citizens, though; even all-Mac Notes groups require an OS/2-based server.)

The most important changes in Release 3.0 are deep in the program. Macro capabilities, a score of new @ functions, and "Object Activation" (a way of placing a Windows OLE object in a blank form) let developers create much more powerful applications. A pair of @ functions enhances Notes' flat-file database structure by letting it perform table searches. Other @ functions generate dialog boxes, and you can link macros to buttons on forms. All these improvements and many more greatly improve Notes' document-routing and workflow-management capabilities.

New search-and-retrieval software creates full-text indexes and supports Boolean searching that's complex enough to meet the needs of most users (though it may fall short in the eyes of experienced research

librarians). You can save queries, and the software ranks documents for relevance to the search terms. There's also a rough form of query by example that lets you enter search text in the proper fields of an empty form.

The full-text search function brings up its own control panel, which unfortunately isn't very intuitive, especially for unsophisticated users. But this added searching power will be put to good use all the same: The maximum size of a Notes database has been bumped up from 300MB to 1GB.

Release 3.0 also provides functions that help Notes administrators set some standards for field names and data formats. Changes made in a template application can be replicated automatically to all the applications based on the template. Fields can be shared among applications, giving administrators some control (however obliquely) over a corporate data dictionary for Notes. The result is that Release 3.0 is a robust development environment that is good for developers comfortable with fourth-generation languages and SQL databases.

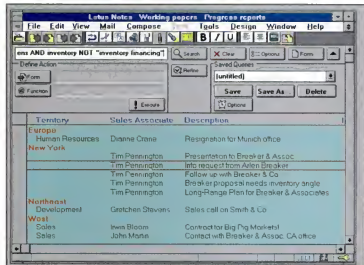
WHAT'S IN IT FOR ME?

Release 3.0 offers end users substantially less than it does application developers. Even some of the weakest areas of Notes haven't been improved in the new version. For instance, an egregious bug in earlier versions that prevents you from saving paragraph styles isn't fixed in Release 3.0. Also, Lotus hasn't addressed the need for improvements in import and export for better handling of formatted text and graphics.

Another problem—running Notes remotely via modem—has received only limited attention. Laptop users will find two



From June 1 through June 4, you can go on-line on PC MagNet to discuss Lotus Notes with David and Sally Blanning DeJean and Lotus Notes product managers. Type GO ZNT:EXEC from any Computer prompt.



TEXT SEARCH: You can build and save complex queries.

First Looks

useful features: selective replication, which finally lets you choose to avoid downloading long formatted documents and huge attachments, and replication in the background, which requires many megabytes of memory to work well.

PRICING

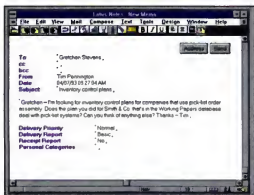
The basic price of a Release 3.0 license (either server or client) is \$495. Lotus also sells the \$995 three-license Windows Starter Pack (which contains a Windows server and two clients) and promises to sell an OS/2 starter pack. Notes for ten workstations will cost

less than \$5,000, and it will perform without compromise. The Windows-based server is limited

works on a larger network.

The paradox is that Notes, once promoted as user-programmable, now looks much more formidable to users who want to develop their own applications—at exactly the same time that Lotus has finally made Notes affordable for very small user-maintained installations.

• List price: Lotus Notes, Release 3.0, \$495 per node; Windows Starter Pack, \$995. Requires: OS/2 server: 12MB RAM, 100MB hard disk space, OS/2 EE or SE 1.2 or later, IBM Extended Services with Database Server for OS/2 1.0, IBM LAN



PUSHY: You can attach entire applications to buttons embedded in Notes forms.

ited to ten concurrent users, but it works for them just as well as its big brother OS/2 server

Remote-Control Software

pcAnywhere: Look Through Windows to a Remote PC

BY CAROL ELLISON

Symantec Corp.'s Norton pcAnywhere, Version 1.0 for Windows, is the best communications news telecommuters and other remote PC users have had in years. It's not the first remote-control package to run Microsoft Windows apps across phone and cable connections, but it's the fastest and easiest to use.

Not only can this Windows application remotely run both Windows and windowed or full-screen DOS applications, it supports more than 90 types of modems that can handle up to 115,200 bps, across-the-LAN connections and modem sharing for both NetBIOS and IPX networks, a scripting language with more than 140 commands and a healthy array of terminal emulations for connections to mainframes and on-line services.

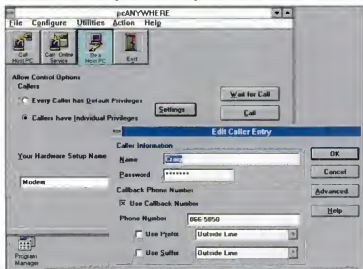
Gone is the tedious wait for the remote screen to refresh when you're working remotely with Windows applications. pcAnywhere's Windows drivers intercept and compress Windows' own video calls and speed

them along the connection in a fraction of the time it takes to send a bitmap. At 9,600 bps, a remote session between two 386-based PCs showed hardly any time lag at all.

What's most impressive is

on the host and remote screens. File transfers are as easy as dragging and dropping a file or directory across a file-transfer screen that displays host and remote files and directories in split-screen File Manager style.

The software is a snap to install and configure for individual use. Network installation requires an understanding of rights, shared directories, file paths, and environment vari-



PRESS AND PLAY: You control pcAnywhere via four buttons.

Symantec's excellent use of Windows. You control program operations from four simple buttons on a master program screen and (during remote sessions) from activity menus that pop up

ables. But you're prompted through it with easy-to-understand menus.

The program has a "quick connect" feature to get you started immediately, but frequent

Server 2.0, Lotus AppleTalk for OS/2, Microsoft LAN Manager 2.0 or later, NetWare 2.2 or 3.11, NetWare Requester for OS/2 1.3, Pathworks for OS/2 2.0, or VINES 4.11. Windows server: 4MB RAM, 60MB hard disk space, DOS 5.0 or later, Microsoft Windows 3.1, Microsoft LAN Manager 2.1, Microsoft Windows for Workgroups, or NetWare 2.2 or 3.1. OS/2 workstation: 4MB RAM, 40MB hard disk space, OS/2 1.2 or later. Windows client: 4MB RAM, 40MB hard disk space, DOS 5.0 or later, Microsoft Windows 3.1. Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 617-577-8500; fax, 617-693-1299.

Circle 418 on reader service card

users will want to take advantage of the many individual security features and customization options. pcAnywhere offers the standard suite, which includes multilayer password protection as well as dial-back, screen-blanking, and keyboard-locking to keep intruders away.

The network capabilities in the basic \$199 package are limited to individual node-to-node connections, making pcAnywhere useful for delivering support to single users but not for group training. The \$599 LAN Complete Pak can handle five additional simultaneous users.

If you've avoided remote computing because the software seemed too mysterious, too slow, or too limited for your needs, the Windows version of pcAnywhere should change your mind. And if you're already working remotely, it's a great upgrade.

• List price: Norton pcAnywhere, Version 1.0 for Windows, \$199; five-user LAN Complete Pak, \$599; upgrade from Version 4.5 for DOS, \$69. Requires: 2MB RAM, 5MB hard disk space, Microsoft Windows 3.x. Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 800-453-1054, 408-253-9600; fax, 408-253-4092.

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New dBASE IV v2.0 gets you home for dinner



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dBASE IV outfoxes the competition

	dBASE IV	FoxPro
Industry standard	Yes	No
Designed for users	Yes	No
Designed for programmers	Yes	Yes
Queries optimized for stand-alone & networked computers	Yes	No
Instantly accessible visual design tools	Yes	No
Full cross-platform compatibility	Yes	No
Transaction processing	Yes	No
Multi-level password protection & data encryption	Yes	No

▲ dBASE meets a much wider range of needs than FoxPro.

*The results of the Product Comparative Usability Testing—DOS Database Software, dated September 1992. †Software Digest Rating Report, multiuser database programs, May 1992. dBASE IV v2.0 and dBASE Compiler sold separately. Copyright © 1993 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. Prices good in the United States and Canada only. All prices are in U.S. dollars. Dealer prices may vary. BI 4384.1

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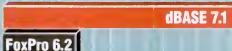


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■ Animation Software

\$995 StrataVision 3d PC: Move Over, Steven Spielberg

BY JEFF MACE

If you admire high-end broadcast-quality special effects, animation, and morphing sequences, Strata's StrataVision 3d PC may be your ticket into that world. At \$995, StrataVision can produce the same stunning results as its pricier competition, Autodesk's 3D Studio (\$2,995) and Crystal Graphics' Topaz (\$4,995). But unlike the others, StrataVision can output directly to a videotape deck capable of single-frame insert edits from a Super VGA, VGA, or Targa-32 card.

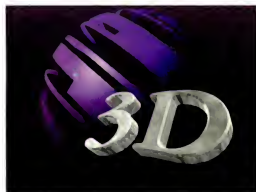
But don't expect to create a new animated logo for CBS on your first day. StrataVision's world is a complex one, where animations contain three-dimensional text that flies in from off-screen, tumbles around under changing light sources, and flashes with special effects. Pulling the pieces together is a challenge. Multimedia users will be happy to know that StrataVision animations can be saved as .FLC, .FLI, and .TGA files.

DOS-BASED

With a somewhat klunky DOS interface that's not totally mouse-friendly, the program might make you feel a little intimidated when you're first learning it. But a comprehensive tutorial and a "Getting Started" videotape will help get you up to speed. StrataVision 3d PC is not simply ported over from StrataVision 3d PC for the Mac. It started out as AIM-3D, which Strata acquired from AIM Graphics, so users familiar with the Mac version will face the same learning curve.

StrataVision is organized into three sections, all accessible from the main menu. The Object

Creation, Sequence Creation, and Utilities sections each contain a number of modules, many of which let you move from one to another.



PHOTOREALISM: Infinite light and camera angles.

You start by creating two-dimensional objects with drawing tools. Here you create and set attributes for 2-D objects that will later be assembled into 3-D models in the Assemble/Design module. There are four different modeler types: Flat, Revolve, Sweep/Outliner, and Sweep/Sweeper. We used the Revolve modeler to create a lamp simply by drawing the outline of one side and setting different line colors and texture maps for each section.

The Sweep modelers are used to create an extrusion treatment that can be applied to any 2-D object while it's being assembled into a wireframe. Both the 2-D object and the wireframe are saved as .KEY files, which the system recognizes when you bring them into the Assemble/Design module, where a wireframe model is created.

You can do a Quick Render to make sure that your texture maps and other treatments (such as transparency level, color, and shading) have been applied

correctly (50 texture maps are supplied, and you can also create your own from any bitmapped file). Then you use the 3-D modeling tools to fine-tune your model.

Perhaps the most powerful 3-D modeling feature in the program, and a fea-

ture unique to StrataVision, is SuperSculpting, which uses the Coons Patch mathematical formula to create a new contour for the sculpted model. By selecting



MORPHING: Transform any wireframe.

1 of the 12 edges of the cube that the program uses as a template, you can augment parts of the model's shape by moving vertices or tumbling and rotating selected edges in any number of ways. Much experimentation is necessary in the beginning to achieve the desired result, but the time spent can lead to amazing results.

Models created with SuperSculpting are great to use in wild

metamorphosis sequences; that is, series of transformations from one wireframe to another. StrataVision creates "in between" from one model to the other. You can even generate this type of sequence between .KEY files with different numbers of points. This is a well-engineered and easy-to-use part of the program. We used morphing to transmogrify a sphere into a lamp, and it was surprisingly easy to do.

Laying out a motion path is necessary when animating several different objects together, and StrataVision handles this well. You lay out your motion path by clicking the mouse to set the points along which the animation will move. Then you're ready to create a run sheet. Set up like a spreadsheet, the run sheet integrates all your sequences and special effects along with your models and motion paths and then generates your animated sequences.

Rendering is always a time-consuming process, especially when you have several light sources and shadows. StrataVision includes Numerical Design's rendering engine, which during testing (on a 50-MHz 486 system with 16MB of RAM, a 7MB RAM drive, and a 32MB virtual swapfile) proved to be fast, rendering 60 frames in 73 minutes.

Despite the steep learning curve and an interface that's in need of context-sensitive help, it's hard to beat StrataVision's versatility. The program is for anyone who needs to do complex 3-D modeling, photo-realistic rendering, and animation with broadcast-quality special effects. StrataVision may be the way you finally get into show business.

● List price: *StrataVision 3d PC*, \$995. Requires: 4MB RAM, 10MB hard disk space, DOS 5.0 or later, math coprocessor. Strata Inc., 2 W. St. George Blvd., Ancestor Square, St. George, UT 84770; 800-678-7282, 801-628-5218; fax, 801-628-9756.

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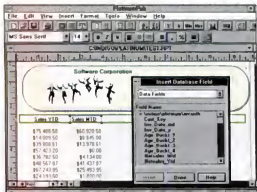
Platinum Overhauls Flagship Program, Releases New Module

Platinum Software Corp. has announced Platinum, Version 4.0, a major upgrade to its LAN-based integrated financial and accounting program; and Platinum Publisher, a visual report generator and the company's first Windows module. Platinum 4.0, a suite of accounting applications ranging from a Foreign Currency Manager to a General Ledger, now supports Windows so you can run multiple Platinum sessions. Specific modules that have received enhancements include the Inventory, Purchase Order, and Order Entry modules. In the PO module you can process orders across multiple locations; in the Order Entry module, improvements include indirect invoicing, enhanced reporting, and shipping and order profiles.

Platinum Publisher works with the Platinum accounting program to process queries across several databases and generate quality reports. It includes object-oriented design tools and supports OLE (Object Linking and Embedding), DDE (Dynamic Data Exchange), and the MDI (Multiple Document Interface). You can link reports in Platinum Publisher to data from a variety of Windows applications, and the report generator comes with a syntax-compatible macro language that resembles Visual Basic.

• List price: *Platinum, Version 4.0, \$1,295 to \$1,995 per module; Platinum Publisher, \$1,995 for entry level LAN module. Platinum Software Corp., 15615 Alton Pkwy., #300, Irvine, CA 92718; 800-426-0469, 714-727-1250; fax, 714-727-3514.*

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Platinum Publisher creates accounting reports.

Photography by Thom O'Connor

HOT
PROSPECT



Canon's New Notebook Has a Built-in Bubble Jet Printer

It's a notebook! It's a printer! Stop, you're both right! **Canon Computer Systems'** innovative design, produced jointly with IBM Japan, is landing on U.S. shores. The Canon NoteJet 486 is based on Texas Instruments' 25-MHz 486SLC processor and has a built-in, 360-dpi Bubble Jet printer under the keyboard and two PCMCIA Type 2 slots. Now when you're away from the office you can print your files or even receive faxes on paper using a PCMCIA-compatible fax modem.

The 7.7-pound NoteJet 486 isn't much larger than a normal notebook (22 by 12.2 by 10 inches HWD), and its nickel cadmium battery is rated at a respectable 4 hours when printing just 8 pages. It has 4MB of RAM, an 85MB hard disk, a 9.5-inch Sharp LCD screen capable of 640-by-480 resolution (it doesn't support simultaneous external display), and a clever hand-held printing device. The printer operates at 116 characters per second, with a 10-sheet feeder and a user-replaceable ink cartridge and printhead. The ink cartridge prints approximately 65 pages and costs \$8, and the print head lasts about 3,000 pages and costs \$43.

• *Canon NoteJet 486, \$2,499. Canon Computer Systems Inc., P.O. Box 5048, 123 E. Paulino Ave., Costa Mesa, CA 92628; 800-848-4123, 714-438-3000; fax, 714-438-3099.*

Circle 402 on reader service card

NEW

Dell Subnotebook Has a Sibling

It took a while to get the Dell 320SLi subnotebook PC out the door, but now that it's been done, **Dell Computer Corp.** will try to improve on its marketing effort with the new 325SLi. It too weighs less than 4 pounds, is a mere 1.25 inches high, and comes standard with 2MB of RAM, a 60MB hard disk, and a PCMCIA Type 2 expansion slot. But the 325SLi, as the name implies, is driven by an Intel 25-MHz 486SL processor for enhanced performance over the system's 4-hour battery life. Models are also available with 4MB of RAM and 80MB, 120MB, or 200MB hard disks, and Dell offers several PCMCIA-standard data/fax modems that support transfer speeds of up to 14,400 bps.

• List price: *Dell 325SLi, \$1,499. Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355, 512-338-4400; fax, 512-794-4238.*

Circle 414 on reader service card

NEW

New AST Notebook Is Pen Ready

First came GrID Systems Corp.'s Convertible notebook PC, and now **AST Research** has its own version of the same pen/notebook computer. The 5.5-pound, 25-MHz 386SL-based PenExec is a notebook PC until you flip over the hinged display and put the wireless stylus to the screen's surface. It comes with 2MB or 4MB of RAM, a 120MB or 200MB hard disk, one PCMCIA Type 2 slot, and an external floppy disk drive. Preinstalled software includes MS-DOS 6.0, Windows 3.1, Windows for Pen Computing, and a demo version of PenWare's PenCell spreadsheet program, which is Excel- and Lotus-compatible. A suite of pen applications known as the AST Pen Essentials is available from Slate Corp. and is marketed through resellers. It includes Loose-Leaf Notetaker, Delrina's WinFax Pen, Day-Timer Pen Scheduler, and PenBook Business Reference Pages.

• List price: *AST PenExec, \$2,895; AST Pen Essentials, \$495. AST Research Inc., 16215 Alton Pkwy., P.O. Box 57005, Irvine, CA 92619-7005; 800-876-4278, 714-727-4141; fax, 714-727-9355.*

Circle 404 on reader service card

NEW

FolderBolt Your Directories For Maximum Security

Applications of all types are finding their way from the Mac to the PC, including **Kent Marsh Ltd.**'s FolderBolt security software, which now provides simple directory protection under Microsoft Windows. It's not memory-resident, so your files are protected even when Windows isn't running. With FolderBolt for Windows, there are three types of protected folders (or directories): completely secure, so you can't access any files without a password; read-only, so you can use applications or view files but can't make changes; and password-protected "drop" folders where you or other users on a LAN can place files that are only accessible by authorized users. If you forget any passwords, there is an Administrator program that, once accessed, acts as a master key for overriding directory security.

FolderBolt for Windows also maintains an activity log so you can see who accessed what folders and when, from the time they started to the time they stopped. The program also performs an automatic internal virus check for added security and lets you automatically relocate all the folders that were unlocked since booting up your PC when you exit Windows. • List price: *FolderBolt for Windows*, \$99. **Kent Marsh Ltd.**, Kent Marsh Building, 3260 Sul-Ross, Houston, TX 77098; 800-325-3587, 713-522-5625; fax, 713-522-8965.

Circle 405 on reader service card

IMPROVED

FotoMan Plus: Point and Click, but Smile First

It may not seem obvious what **Logitech** has done to make its FotoMan Plus Digital Camera better. But when you try it you'll soon discover that its resolution has been increased 67 percent, battery life is up from 36 to 100 hours, and the speed and accuracy with which the camera communicates with a serial port during data transfer has been enhanced.

The main lens of the FotoMan Plus is now 65 mm rather than 55 mm (making it better for portraits), and a self-regulating flash ensures proper exposure from 16 inches to 6 feet. The camera's on-board software has been improved, and it now supports JPEG compressed files.

Also new: the tactile feedback trigger that immediately confirms you've taken a picture. For die-hard photographers, a variety of lenses, including wide-angle, telephoto, and close-up,

BRIEFS

CD-ROMs

IBM's educational systems company, **EduQuest**, has unveiled *Picture Atlas of the World* (\$143), a world atlas on CD-ROM, codeveloped with the National Geographic Society and featuring recent world changes, maps, captioned photos, essays, computer animation, and music, video, and audio clips. Each country has a menu that lets you see more maps showing cities, transportation networks, and places of interest. The product is available at a national education discount price of \$100. 800-426-3327.

World Library has announced *Murder, Mystery, Magic, Terror & More* (\$49.95), a CD-ROM containing 171 classic murder and mystery stories in Windows/MPC-compatible format, with search and cut-and-paste capabilities, and both DOS and Windows versions on the same disk. The vendor has also announced joint Windows/DOS versions of the *Greatest Books Collection* (\$49.95) and the *Electronic Home Library* (\$79.95). 714-748-7197; fax, 714-748-7198.

Softbit is shipping *Power Tools for DOS* and *Power Tools for Windows* (\$99.95 each), two CD-ROM products with a wealth of productivity tools. The DOS disk contains over 3,000 applications and utilities ranging from accounting to word processing; the Windows disk has over 600 tools including drivers, fonts, and entertainment programs. 714-251-8600; fax, 714-261-7336.

Bureau Development, the company that put *Monarch Notes* as well as great works of literature on CD-ROM, has announced *The Complete Twain* (\$39.95), over 300 works of Mark Twain, including essays and letters; and *Multimedia World History* (\$79.95), over 75,000 pages of text, 600 photos, illustrations, and maps, and 70 video segments covering the history of the world. 201-808-2700; fax 201-808-2676.

SOFTWARE UPGRADES

Symantec Corp. is shipping *The Norton Desktop for Windows*, Version 2.2 (\$179), which is MS-DOS 6.0-com-

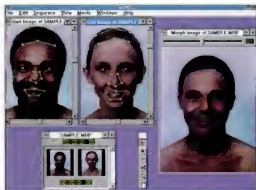
patible with third-party suppliers. Current FotoMan users can buy software-only or complete hardware/software upgrades directly from Logitech, and Unix versions are also available. • List price: *FotoMan Plus Digital Camera*, \$799. **Logitech Inc.**, 6505 Kaiser Dr., Fremont, CA 94555; 800-231-7717, 510-795-8500; fax, 510-792-8901.

Circle 406 on reader service card

NEW

Terminator 2 Meets the PC: Vendors Ship Morphing Software

Two software vendors are bringing morphing, the technology that turned the villain in *Terminator 2* into a Swiss Army knife, to Windows-based PCs. **Gryphon Software Corp.** is porting its Mac product, *Morph*, while **Black Belt Systems** is bringing over its Amiga product, *WinImages*: morph. In both products, you specify a starting image and an ending image that appear side by side on your screen. Then you click on a number of points in an image, and the software makes the changes over a certain number of frames.



In *Morph* for Windows, you pick points on two images and let the software perform the changes.

Images can be saved in a variety of animation formats for exporting to videotape or film, as well as in single-frame image formats such as .GIF, .TIFF, and .Targa. Both vendors recommend that you run the programs with more than 4MB of RAM and at least 1MB of video RAM to support 256 colors, plus any number of other performance enhancers from an accelerated video card to a math coprocessor. Look for Windows NT versions to further accelerate morphing performance.

• List price: *Morph* for Windows, \$149. **Gryphon Software Corp.**, 7220 Trade St., #120, San Diego, CA 92121; 619-536-8815; fax, 619-536-8932. *WinImages*: morph, \$199.95. **Black Belt Systems**, 398 Johnson Rd., Glasgow, MT 59203; 800-852-6442, 406-367-5513; fax, 406-367-2329. Circle 407 on reader service card

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PC WORLD May 1993

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4/33s



Video Performance Under Windows
i486DX2/66 CPU, Winmarks
V.2.5, High Score Wins

EISA) slots to provide twice the data path and three to four times the speed of the ISA bus alone. VESA compliance guarantees compatibility with a variety of third party local bus enhancements (video adapters, disk controllers, etc.), while adaptability to future applications is enhanced by a single chip upgrade path to Pentium processing. A third local bus slot, ALR's CL extension, accommodates the innovative ALR TriCombo™ board. This unique option combines local bus cache and video with high performance Ethernet networking capabilities.



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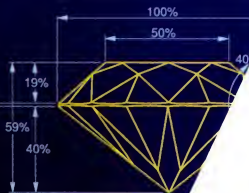
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The diamond. A product of the millennia that is everlasting. Clear, brilliant and dazzling – an appropriate reflection of the literal translation of the Mitsubishi name, which means *Three Diamonds*. Like the diamond, Mitsubishi's family of 14"/16" value priced Diamond Scan and 14"/17" high performance Diamond Pro®

color monitors are the industry benchmark for quality and longevity, as

well as application versatility. ♦ All Mitsubishi monitors feature high-resolution and low

emission designs – at an affordable price. And unlike other monitors that

often fail after just one year, Mitsubishi monitors are engineered to last

and are backed by a two-year warranty on parts and labor. ♦ The

Diamond Scan 14 has SVGA performance up to 1024 x 768 interlaced, while the Diamond Pro 14 offers flicker-free 1024 x 768 non-interlaced resolutions (up to

72 Hz) for full Windows™ compatibility. ♦ For advanced Windows or Macintosh® based high-resolution applications requiring a larger display, the Diamond Scan 16 provides 39% more display area than 14" models and 19% more than 15" FS designs, without crowding your desktop. The Diamond Pro 17 offers an even larger

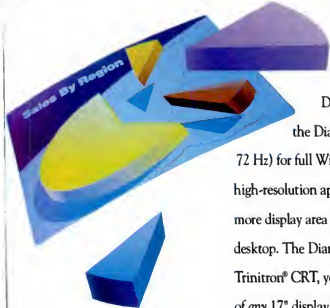
Trinitron® CRT, yet has the most compact enclosure of any 17" display. Both models feature the Diamond

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Mitsubishi Electronics America, Inc., Display Products, 5665 Plaza Drive, Cypress, CA 90630
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CIRCLE 280 ON READER SERVICE CARD

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New & Improved

NEW

New Server from Ariel Design Satisfies the Power Hungry

Ariel Design, known for sparing no expense when it puts together a high-performance system, is offering a new file server to make the power user drool. The Ariel 486DX2-66EVS is an EISA-based tower PC with two VESA local-bus slots and an AMI EISA/SCSI Host Adapter. The AMI Enterprise III motherboard holds up to 256MB of RAM (8MB come standard), has 256K of external cache, and has a P24T ZIF socket for future Pentium technology upgrades. The video subsystem is based on the new SixGraph Wizard 9000VL, which uses Weitek's sizzling P9000 coprocessor with 2MB of VRAM, and supports 256 colors at 1,280 by 1,024 resolution.



The Ariel 486DX2-66EVS: A power server.

The Ariel 486DX2-66EVS also comes with an 877MB Toshiba SCSI hard disk, a 15-inch ViewSonic 15 monitor, MS-DOS, Windows, and a choice of Borland application software.

• List price: *Ariel 486DX2-66EVS*, \$4,995. *Ariel Design Inc.*, 145 Webster St., Hanover, MA 02339; 800-952-7435, 617-982-8800; fax, 617-982-9095. Circle 410 on reader service card

NEW

Yamaha Ships External MIDI Sound Solution

Yamaha Corp. of America, makers of PC sound chips, has stepped out from behind the curtain to deliver Yamaha Hello!Music!, an external sound solution for multimedia applications that doesn't require an expansion card because it attaches to your

BRIEFS

SOFTWARE UPGRADES

patible with the ability to recover data from DOS 6.0 compressed drives and read/restore DOS 6.0 backups. The new Norton Desktop also supports Windows for Workgroups, and its virus detection program hunts down 100 new strains. The program is available for \$99 with the purchase of DOS 6.0. 800-441-7234, 408-252-3570.

Iterated Systems' desktop publishing tool, *Images Incorporated III* (\$299), now has advanced compression technology, OLE support, and support for Fractal Transform Template (FTT) files. FTT files identify related regions within a group of images to improve compression and image quality for the group. A new Archive Mode further compresses fractal files by 10 to 20 percent. 800-437-2285, 404-840-0310; fax, 404-840-0806.

Power Up Software Corp. is shipping Version 3.0 of its desktop publishing software, *Express Publisher* for DOS (\$99.95 through June 30). The most important enhancement is the Layout Advisor feature, which guides you through the design of a layout, giving you a thumbnail view of the document as you explore layout options. Layout Advisor automates tasks such as setting up a grid system and selecting matching typefaces. 415-345-5900; fax, 415-349-1356.

CE Software has announced Quick-Mail, Version 2.6 (\$649 for 10 users), an update to the company's cross-platform e-mail system that supports Apple's Open Collaborative Environment and Novell's Message Handling Service. A variety of tools have been installed to aid the system administrator, including the ability to work on the server remotely. 515-224-1995; fax, 515-224-4534.

HARDWARE

DynaPoint is shipping the Cordless DynaMouse (\$89.95), an infrared cordless mouse, which lets you control your PC's various interfaces from distances up to 6 feet away and at 90-degree angles. A receiver replaces your regular mouse and sits on your desktop to receive signals from the battery-operated

PC's serial port. At the heart of the system is the Yamaha CBX-T3 Tone Generator, a compact module that provides 192 instrument sounds, 10 drum kits, and digital reverb. It features a MIDI interface that is interchangeable with MS-DOS, Macintosh, and laptop PCs by flipping a switch, and it's fully MIDI compatible so you can access preprogrammed libraries of MIDI music. The CBX-T3 can also act as a connection between your PC and another MIDI device and can accept audio input from any audio device, including a portable tape/radio player, a CD player, or even a microphone.

Hello!Music! comes with Turbo Trax software from Passport Designs. It includes a music recorder for entering notes, a MIDI Player for mixing and editing music, and a selection of preprogrammed tunes. Yamaha CBX-S3 Speakers and the Yamaha CBX-K3 Keyboard are available separately for \$299.95 and \$399.95, respectively.

• List price: *Yamaha Hello!Music!*, \$449. *Yamaha Corp. of America, Consumer Products Division*, P.O. Box 6600, Buena Park, CA 90622-6600; 714-522-9240.

Circle 408 on reader service card

NEW

Command View Creates Universal Toolbars for Windows Apps

Toolbars are all the rage in Windows apps, but what if you can't remember what every iconic button on every toolbar in every app means? **Artist Graphics** proposes a solution with its *Command View*, Version 2.0, a universal toolbar for Windows applications that pops up when you click the right mouse button. It can be customized for each application while maintaining common icons for routine tasks. Any Windows application can be assigned to a button on each Command Pad. When you start a new application, the Command Pad that you've assigned to it appears the next time you hit the right mouse button.

There's a keyboard override so that Command View doesn't conflict with applications such as Excel, and icons can be used from any Windows program. The number and size of the buttons are user-definable—Command Pads can measure up to 12 buttons wide by 10 buttons deep—as are the icons themselves. Over 500 bitmapped icons and 20 Command Pads are included to get you started.

• List price: *Command View, Version 2.0*, \$49.95. *Artist Graphics*, 2675 Patton Rd., St. Paul, MN 55113; 800-627-8478, 612-631-7800; fax, 612-631-7802.

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Based on DX/33, DX2/50 and DX2/66 Intel® processors, AcerPower® delivers plenty of speed and performance for today's demanding Windows® applications. But don't



take our word for it—pick up the February issue of *PC World* and find out why the AcerPower 486e DX2/50 is a Best Buy.



In today's aggressive business environment, long-term survival is a matter of strength. And nowhere is this more true than in the computer industry.

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Self-reliance is strength. At Acer, we don't rely on other manufacturers to build our computers—we make Acer systems out of Acer components. This allows us to ensure quality and pass the savings along to our customers.

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FEATURES	MODEL 5367	MODEL 5567	MODEL 5667
CPU	486DX/33	486DX2/50	486DX2/66
MEMORY	4MB, Exp. to 256MB	4MB, Exp. to 256MB	4MB, Exp. to 256MB
CACHE	128K	128K	128K
HARD DISK	240MB	240MB	240MB
FLOPPY	3 1/2"	3 1/2"	3 1/2"
ACCEL. VIDEO	Local Bus (1280 x1024)	Local Bus (1280 x1024)	Local Bus (1280 x1024)
I/O	EISA	EISA	EISA
MONITOR	15" NI EVGA .28 Flat Square Overscan	15" NI EVGA .28 Flat Square Overscan	15" NI EVGA .28 Flat Square Overscan
SOFTWARE	DOS [®] , Windows [®]	DOS, Windows	DOS, Windows
WARRANTY	One Year On-site	One Year On-site	One Year On-site
MSRP	\$2,599	\$2,799	\$2,999

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NEW

New Panasonic Notebooks Have Disk Compression, PCMCIA Slot

Panasonic Communications and Systems Co. has announced two new notebook PCs, the CF-580 (monochrome) and the CF-580C (active-matrix color) that utilize Intel's 3.3-volt 486SL processor and nickel metal hydride batteries for up to 4 hours of continuous operation. A subbattery holds data in memory even when the main battery is removed. Both come with a 120MB hard disk, which can be doubled using the SuperStor disk compression software that's already installed, and a PCMCIA Type 2 slot for LAN adapters, modems, or RAM cards. A trackball sits above the keyboard, and the display tilts 180 degrees and supports simultaneous external display.

• List price: *Panasonic CF-580*, \$2,899; *Panasonic CF-580C*, price not yet available. *Panasonic Communications and Systems Co.*, Two Panasonic Way, Secaucus, NJ 07094; 800-742-8086, 201-348-7000.

Circle 412 on reader service card

NEW

Transverter Pro: Graphics File Sharing Across Platforms

TechPool Software has released *Transverter Pro*, a software-only solution for importing graphics files from DOS, OS/2, NeXT, and Unix platforms into Windows and Macintosh applications by utilizing a built-in PostScript-equivalent interpreter. To create a universal graphics file you print the file to disk using a PostScript printer driver, then *Transverter Pro* accesses the files and converts them so they can be imported into all programs. Other PostScript-compatible interpreters, such as Color-Age's Freedom of Press, are raster image processors (RIPs) that convert PostScript data to either bitmapped files, like TIFF files, or to raster data for printing. *Transverter Pro* can also perform as an RIP.

Transverter Pro supports ATM Type 1 and Type 3 fonts and is compatible with major network operating systems. It can translate between vector formats such as Adobe Illustrator, EPS, and PostScript, as well as convert vector formats to bitmaps like .BMP, .GIF, .PCX, .TIFF, .TGA, and Group 3 Fax.

• List price: *Transverter Pro for Windows*, \$395. *TechPool Software Inc.*, 1463 Warrensville Center Rd., Cleveland, OH 44121-2676; 800-925-6998, 216-291-1922; fax, 216-382-1915.

Circle 411 on reader service card

BRIEFS

HARDWARE

mouse. 818-854-6440; fax, 818-854-6444.

Extended Systems has announced four new PocketPrinterServers (\$495 to \$895) that support TCP/IP, Microsoft LAN Manager, and VINES. The ESI-2831A, ESI-2832A, and ESI-2836A connect to Ethernet networks, and the ESI-2850A connects to a Token-Ring network. Each PocketPrinterServer lets you connect a parallel printer anywhere on the network, eliminating the need to chain the printer to a file server or dedicated workstation. 800-235-7576, 406-587-7575; fax, 208-377-1906.

Mustek's PrinScan 105 (\$299), the scanner adapter system that plugs into your parallel port, is now Twain-compliant and lets you scan in both DOS and Windows. It ships with the Matador 105 gray-scale scanner; Skankit for Windows, Version 2.1; Skankit Gray for DOS; and Perceive Personal OCR. 714-453-0110; fax, 714-453-1010.

Video Seven has introduced the WinSwift family of video boards for 16-bit ISA local-bus operation (\$179) and 32-bit VESA local-bus operation (\$209). The boards, based on Cirrus Logic's CL-GD5426 controller, feature 1MB of DRAM, a 1,280-by-1,024 resolution, and a wealth of drivers. 510-656-7800; fax, 510-659-9285.

Notebook upgrade vendor **Laptop Solutions** has introduced a 2.5-inch, 260MB hard disk upgrade for all notebook PCs (\$1,495). You make an appointment with Laptop Solutions, send them your notebook, and the company performs the upgrade and transfers all your data. 800-683-6839, 713-789-0878; fax, 713-789-8177.

SyDOS has announced the Pro-Note (\$899), 2.5-inch 42MB external removable cartridge Winchester disk drive for portable PCs. The 1.8-inch high drive, with a 14.5 ms. average seek time, connects to the PC's parallel port and has a pass-through connector so you can keep printing. Additional 42MB cartridges cost \$239. 800-437-9367, 407-998-5400; fax, 407-998-5414.

NEW

OS/2 Utility Displays Audio, Image, and Video Files

Commix SP's new 32-bit OS/2 utility, *DisplayMaster*, lets you browse audio, image, and full-motion files simultaneously on-screen. With *DisplayMaster* you can view all the images on a Kodak Photo CD disk in thumbnail sizes and convert the images to common formats. Each window open in *DisplayMaster* has its own set of controls, and the number of DVI, audio, and image windows open at one time depends on the amount of free resources. If you need to annotate files, *DisplayMaster* will save comments made on any of the files it reads, which you can recall at a later time to review or use as presentation tools.

• List price: *DisplayMaster*, \$49.95. *Commix SP Inc.*, 8201 Greensboro Dr., #451, McLean, VA 22102; 703-356-9858; fax, 703-356-6148.

Circle 413 on reader service card

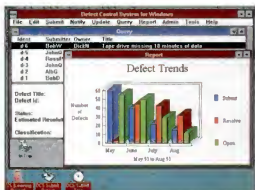
IMPROVED

DCS Finds Bugs As You Program

The Software Edge is shipping *Defect Control System (DCS)*, Version 2.0, a Windows-based app that gathers bug information during software development. DCS guides you through entering bug information, keeps an audit trail, notifies your coworkers of new bugs or updates, classifies bugs for easy querying, and generates trend reports to predict release dates, detect bad code, and forecast customer failure rates. DCS provides field-level security and supports importing bug records from your current database and exporting DCS records to databases, graphics files, spreadsheets, and word processor files.

• List price: *Defect Control System for Windows, Version 2.0*, \$695. *The Software Edge Inc.*, 4420 Laven Way, Colorado Springs, CO 80920; 719-598-3713; fax, 719-598-3970.

Circle 415 on reader service card



Defect Control System tracks bug information.

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This 3.5" low-profile drive features an embedded AT interface and a data transfer rate of 6 MB per second. Combined with

the low price, the ST3243A represents one of the best values you'll find in the computer industry this year.

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Seagate

People who choos instead of 1-2-3's 3-

Chapter 4: Managing Document Files

Managing Documents with Workbooks

Organizing your Microsoft Excel documents into workbooks makes it easy to manage your document files and keep related information together. By opening or closing a single workbook document, you can open or close all of the documents you need for a specific task.

A workbook is a type of Microsoft Excel document in which you store other documents or information about other documents. A document stored in a workbook file is bound in the workbook. An unbound document appears in a workbook's list of documents, but the document file itself is stored outside the workbook file.

The following illustration shows bound documents and an unbound document of a workbook file. The bound documents are stored in the workbook file QSALES. The unbound document SUMMARY, however, is not stored in the workbook file. It is stored separately, but it is accessible from the workbook. That is, you could work with the file SUMMARY from the workbook QSALES.

This unbound document is stored separately from the workbook file, but is still accessible from the workbook.

These titles tell you whether a document is bound or unbound in the workbook.

These titles tell you whether a document is bound or unbound in the workbook.

While bound documents such as EAST can be bound in only one workbook at a time, unbound documents such as SUMMARY can appear unbound in several workbooks at a time.

Microsoft Excel 3.1

Excel's Workbook is great for anyone considering going back to school. You get a whole new set of rules to learn.

e Excel's Workbook D have a lot to learn.

The first thing they'll have to learn is an extensive set of new commands and procedures.

Because unlike 1-2-3's 3-D, which lets you work just like you do in 1-2-3's 2-D, Excel's Workbook has a whole new set of rules.

The second thing they'll learn is that Microsoft® Excel doesn't really have 3-D architecture. Instead, it takes separate 2-D worksheets, each saved separately in its own file, links them and stores them together in what they call a Workbook.

1-2-3's true 3-D architecture, on the other hand, actually lets you work multiple worksheets, tightly integrated, in one file.

Because they are in one file, it's easy to create formulas, graphs and formatted reports that actually function across individual worksheets.

2-D can look like 3-D, but...

It doesn't take long to learn what you're giving up.

Because Excel's 2-D worksheets are each in their own file, it's more difficult to work with them together.

So while 1-2-3's GROUP mode stays in effect as you move from sheet to sheet, Excel's shuts

off every time you move to another sheet.

While 1-2-3* users can assign rangenames and formulas across 3-D ranges, Excel users can't.

While 1-2-3 users can graph 3-D data in one step, Excel users can't.

While 1-2-3 users can create 3-way what-if tables, Excel users are limited to 2-way tables.

And while 1-2-3 is fully compatible with 1-2-3 for DOS 3-D files, Excel is not.

Compared to true 3-D, Excel's Workbook process is invariably more complex, less intuitive, more work intensive, and because everything is done through data links, slower.

In fact, it can take Excel 10 times longer than 1-2-3 to recalculate a multisheet file.

Learn now. Save time later.

It boils down to this. A 2-D spreadsheet is not a 3-D spreadsheet. 1-2-3 is true 3-D. And you already know how to use 1-2-3.

To realize the powerful benefits of a 3-D spreadsheet for Windows™, visit your Lotus Authorized Reseller. Or call for your free demo disk and Lotus White Paper on the benefits of 1-2-3's 3-D architecture, at **1-800-TRADEUP, ext. 8870**, today.*



Lotus

1-2-3 Release 1.1
Spreadsheet for Windows

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Processor Upgradable			•	•	•
Memory/Cache	2MB	4MB/128k	4MB/128k	4MB/128k	4MB/128k
Hard Drive	105MB	105MB	170MB	170MB	215MB
Windows Accelerator		Yes/1MB	Yes/1MB	Yes/1MB	Yes/1MB
1.44MB FDD	•	•	•	•	•
1.2MB FDD	•	•	•	•	•
32 Bit VESA Local Bus Slots		Yes/2	Yes/2	Yes/2	Yes/2
14" 1024x768 Monitor	•	•	•	•	•
Mini Desktop Case	•	•	•	•	•
RAM Expandable to 32MB	•	•	•	•	•
Write through RAM cache expands to 256K	•	•	•	•	•
101-Key Keyboard	•	•	•	•	•
Serial Mouse	•	•	•	•	•
MS-DOS 6 & Windows CompuServe	•	•	•	•	•
Toll-Free Technical Support	•	•	•	•	•
One Year Limited Warranty	•	•	•	•	•
30-Day Money Back Guarantee	•	•	•	•	•
PRICE	\$999	\$1295 With Local BUS \$1499	\$1795	\$1895	\$2095



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LeaderBook Pro

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486SX/25 or 486DX/33 processors • 4 MB RAM • 80 or 120 MB HDD • 1.44MB, 3.5" floppy
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• Full size keyboard with separate "PgUp" and "PgDn" keys, a total of 84 keys • Ergonomic palm-rest and trackball, keyboard lift feature • 12 function keys • External keyboard port • DOS 6 & Windows 3.1 pre-loaded • 9.2" x 11.3" x 1.9", only 6.6 pounds • carrying case

ADDITIONAL OPTIONS

FAX/MODEM • 200MB HDD • Auto adapter • Extra Ni-Cad batteries • Memory expansion cards

CONFIGURATION	MONOCHROME	DUAL SCAN COLOR	ACTIVE COLOR
486/SX-25 4 MB RAM 80 MB HDD	\$1695	\$2395	\$3295
486/DX-33 4 MB RAM 80MB HDD	\$1995	\$2695	\$3595
SPECIAL I 8MB RAM 120MB HDD FAX/MODEM	ADD ONLY \$499 FOR THE POWER BUNDLE!		

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ADDITIONAL OPTIONS

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Awards (1992-1993)

ComputerWorld I/S Brand Preference
Winner, February 1992

Windows Magazine WinAward, February 1992

LAN Times Reader's Choice, March 1992,
January 1993

InfoWorld Product of the Year, March 1992

BYTE Magazine Reader's Choice, June 1992

BYTE Magazine Award for
Cross-platform E-Mail, March 1993

Network Computing's Certified Interoperable
Application Award, December 1992

Network World's Enterprise
Technology Award, December 1992

Software Digest's Highest Overall Evaluation,
8.7 Rating, 1992

MacUser Editors' Choice Award, 1992

MacWEEK 1992 Editors' Choice
Diamond Award, December 1992

UNIX World's Best Product of the Year for
1992, January 1993



MICROSOFT MAIL

Awards (1992-1993)

PC Magazine Editor's Choice Award
October 27, 1992

In the e-mail arena, this is what they call running up the score.

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REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Carol Levin

Polish Your Artistic Skills With CorelDRAW Experts

BY LUISA SIMONE

CorelDRAW is chock-full of easy-to-use tools and automated special effects. But in and of themselves, these powerful features don't guarantee you great drawings. They don't teach you basic drawing skills. They don't explain the difference between vector and raster file formats. And they don't warn you of the inevitable problems associated with complex drawings.

For this kind of information, you'll have to turn to one of the many available books about CorelDRAW. Two newcomers in this group take radically different approaches to teaching you the ins and outs of this powerful program.

Steve Rimmer's *Mastering CorelDRAW 3* addresses the needs of novice users by stressing basic drawing skills. Indeed, the best exercises in the book focus on line drawings—the backbone of any vector illustration. In the course of these well-constructed projects, Rimmer explains how even seemingly simple drawings can (and should) make use of CorelDRAW's advanced drawing and object manipulation functions. In the first exercise, you will find yourself using alignment, grouping, and duplication functions quite naturally.

Similarly detailed exercises are mysteriously absent from subsequent chapters, which focus on type tools, fill options,

and special effects. But despite the lack of hands-on instruction, these chapters contain first-rate information. Numerous illustrations serve a dual purpose: They help you to understand basic design concepts, and they demonstrate how you can use various options within CorelDRAW to affect your pictures.

While sometimes daunting to read, Rimmer's lengthy technical explanations are a constant reassurance of his personal knowledge of the software. For example, Rimmer does not merely parrot information about CorelDRAW's 256-character limit for artistic text. He explains how you can overtax system resources even before you hit this limit by choosing a complex typeface, then tells you how to avoid this problem. Impatient artists can use the Fast Track crib sheets (synopsized instructions on the most frequently used tools and functions) or handy tip boxes to brush up on basic skills or troubleshoot problems.

Two companion disks contain files of winning CorelDRAW contest entries, including the now famous picture of Rex the iguana. While readers will find it instructive to disassemble these drawings, they ultimately remain more entertaining than useful.

In contrast, there are several shareware utility programs that can help CorelDRAW users to work smarter. FixFont, for example, automatically changes CorelDRAW's ersatz font names into standard commercial equivalents. Instead of working with Switzerland and Palm Springs, you can work with Helvetica and Palatino.

If you're the type who can learn a product only by actually using it, then consider Jim Karney's newest Corel book, *Power of CorelDRAW!*. Sprinkled throughout the text are simple exercises that help you master specific skills, such as editing Bezier curves. In addition, full-blown design projects give you the opportunity to re-create a logo, an advertisement, or a landscape illustration.

plunge into fairly complex drawings where you'll be modifying lines, filling shapes with colors and patterns, and managing multiple objects. These fast-paced exercises are not for the timid but can help already-competent users advance to a new level of proficiency.

Power of CorelDRAW! showcases the work of seven talented artists and uses their original drawings to demonstrate CorelDRAW's advanced features, such as transparent effects, pen-and-ink simulation, and combined bitmapped and vector images. These chapters do not contain step-by-step recreations of the drawings but instead explain the strategies, secret techniques, and old-fashioned hard work used by real artists to make real art.

Mastering CorelDRAW 3 and *Power of CorelDRAW!* are welcome additions to the library of CorelDRAW books. And both books are now being updated for the upcoming release of the next version. Though they teach different lessons, ultimately Rimmer's patient and clear explanations are a perfect foil for Karney's real-world tutorials. □

• **Mastering CorelDRAW 3**, by Steve Rimmer, \$34.95.

Sybex Inc., 2021 Challenger Dr., Alameda, CA 94501; 800-227-2346. ISBN: 0-782-11154-8.

Circle 462 on reader service card

• **Power of CorelDRAW!** by Jim Karney, \$34.95. MIS: Press, 115 West 18th St., New York, NY 10011; 800-488-5233. ISBN: 1-55828-225-4.

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Learn how artist Gary Bouton created this image in *Power of CorelDRAW!*

Karney's task-oriented approach results in design projects that utilize all of CorelDRAW's various tools and functions synergistically. So be prepared to



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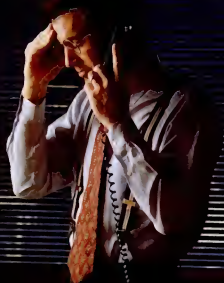
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CIRCLE 136 ON READER SERVICE CARD

Toolkits

REVIEWS OF THE LATEST TOOLS FOR THE PC PROGRAMMER

Edited by Trudy Neubaus

Make Your DOS Programs Sing with WORX 2.01

BY J.W. OLSEN

These days, even your best programs can seem anemic when compared with other software, simply because they lack music, digitized voices, and other sound effects. Perhaps you've given up on some sound libraries because they are too complex, demand excessive system resources, or require royalties for each copy of your program that you distribute. If so, give your DOS programs new vigor with WORX Toolkit, Version 2.01.

Written in assembly language, WORX is equally at home in Microsoft C/C++, Borland C++, Turbo C/C++, or Turbo Pascal environments. Once installed, this royalty-free, linkable library demands about 15K of RAM—but not for long. As you'll see in a moment, you can recoup this RAM, plus any memory allocated to buffers (which varies according to your own programming needs), through a clever "resource-file" strategy. This strategy shuttles data for sounds and other objects into memory from what the documentation calls *resource files*.

The function library is so well crafted that the only clues that publisher Mystic Software is a newcomer to the field are modest packaging and some omissions in the documentation. Without a word in the printed manual about installation, you are left to your own devices to get the software up and running. Copying files to my hard disk proved insuffi-

cient, yet logging on to the distribution disk and running INSTALL worked only in a fairly bare environment: Once I closed Windows 3.1 and deactivated Central Point Anti-Virus, the INSTALL program was successful. Thereafter, I found that the supplied batch files which adapt the toolkit to a particular compiler weren't entirely compatible with the directory structure that INSTALL created. Finally, one sample program wouldn't compile within Turbo C's integrated development environment because it contained in-line assembly code.

Moderately experienced developers will work around these shortcomings, manage without a tutorial in the documentation, and soon be running at top speed. However, getting started will be somewhat challenging for novices; Mystic would do well to devote a bit more of its development resources to making its product friendlier for novices.

Don't be dissuaded from an otherwise-fine toolkit for these oversights, however. The 35-function library is so inviting and solidly designed that it is worth the start-up nuisances. With barely a look at the documentation and sample files, I had my screen-saver utility cheerfully playing a background tune in minutes.

Unlike its competitors, such as the Creative Labs FM-Driver, WORX does not re-

quire a device driver or stay-resident module to perform its magic; it simply links into your code—a welcome approach for novice and experienced developers alike. Then, with a minimum number of function calls, your program can play standard MIDI (formats 0 and 1) and .CMF files. (Creative Music Files—.CMF—use a format from Creative Labs and Creative Technology.) The product also supports a standard sound bank for the Roland MT-32 MIDI synthesizer, which can be customized on the fly. So playing a sequence is just a matter of loading and playing.

Digitized .VOC files (Creative Labs' sound-file format) are also supported, and may even be played simultaneously with MIDI or .CMF files. Long .VOC files should be accessed from a hard disk to conserve memory. (Floppy-disk access is too slow for satisfactory results.) Shorter .VOCs can be loaded into memory—which is particularly handy for repeated play, such as sound effects in games.

Though primarily designed for Sound Blaster and Sound Blaster Pro (DSP 2.0 or higher for .VOC files), WORX Toolkit, Version 2.01, adds support for ordinary PC speakers—albeit with their predictably poor quality. Mystic's toolkit includes a utility to convert .VOC files into the Pulse Width Modulation files suitable for PC speakers.

If your programs contain or require extensive sound, graphics, text, or other data, WORX's Resource Manager will delight you. In effect, this utility merges virtually any type of data into

a single WORX resource file, from which you can readily extract elements on demand. Thereafter, your program can access any element within the resource file just as though it were an ordinary disk file. In fact, WORX functions look first for a resource file and search it for the desired "file." If not found, the directory is automatically searched for a conventional file by the same name.

The resource file concept greatly simplifies the distribution and installation of programs, as just one file can replace numerous separate files, often saving disk space in the process. But most important, maintaining all data in a single file significantly reduces access time, since your program needn't wade through directories for each element as needed. At the same time, your program requires less RAM, unburdened from loading text and so on until actually needed. After use, data buffers can be discarded. As a bonus, you needn't worry about closing individual files or about end-of-file markers; the Resource Manager handles these details for you.

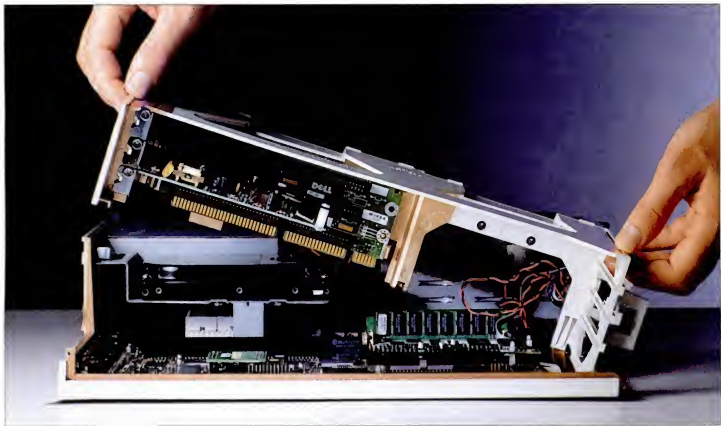
Mystic is currently enhancing WORX to embrace additional sound cards and sound-file formats; some of these enhancements are expected to be supported by the time you read this. But for a reasonable \$79, which includes unlimited future upgrades and technical support, why wait? □

• **WORX Toolkit, Version 2.01**
List Price: \$79. Requires: Microsoft C/C++, Borland C++, Turbo C/C++, Turbo Pascal, or an assembler. Mystic Software, 1504 Encinal Ave., Suite D, Alameda, CA 94501; 510-865-9189; fax, 510-865-9563.

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Michael J. Miller

New PCs, New Ways of Working

The PC is dead. Long live the PC. What is dying—or at least changing dramatically—is our definition of the PC. We're seeing new operating systems, such as Windows NT and OS/2. We're seeing new platforms, such as those built on

the Pentium processor, the Digital Equipment Corp. Alpha, and the IBM PowerPC. These developments have already changed and broadened our view of the PC. But the more important changes are even more subtle: New operating systems and new platforms will lead to new ways of working. And new user interfaces, new ways of combining applications, and radically improved networking will change the way we look at the PC.

CHANGING DEFINITION

The definition of the PC has evolved remarkably over the past dozen years. When *PC Magazine* was founded in 1981, the answer seemed obvious: PC meant the IBM PC, Big Blue's 8088-based entry into the microcomputer world. Yes, that term belied years of personal computers made by other vendors, but it seemed to fit. PC meant the IBM PC.

A few years later, the definition evolved to include machines that were compatible with the IBM PC. Companies like Compaq succeeded in creating machines that support all of the popular PC applications and add-in boards. PC meant the IBM PC and compatibles.

In 1984, IBM expanded the PC standard with the PC AT, and a few years later, Compaq and ALR led the rest of the industry with early 386-based compatibles. Other vendors followed suit, and broadened the PC standard with new video, disk drive, and peripheral standards. In 1987, IBM introduced the PS/2 family with its Micro Channel Architecture. However, most of the other computer vendors stayed with the original PC bus design (called the Industry Standard Architecture, or ISA), while others jumped on the EISA bandwagon. Suddenly, PC meant those machines that

were compatible with the PC standard, not necessarily with IBM's computers.

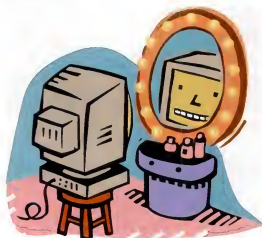
In the late 1980s and early 1990s, the PC standard broadened further, with innovations such as 486 processors, Super VGA, and the IDE standard for hard disks. PC meant machines based on Intel chips running MS-DOS.

Then companies such as AMD and Cyrix introduced chips that were compatible with those made by Intel's x86 line. Operating systems began to proliferate as well. Microsoft Windows gained millions of converts, but Microsoft's operating systems faced competition from products such as DR DOS from Digital Research (later acquired by Novell) and OS/2 from IBM.

PCs moved from being standalone machines to parts of networks, and we began to see standard PCs used as servers, and other machines based on PC components introduced as dedicated servers. In this arena, Novell's NetWare became the dominant operating system, with Banyan's VINES and OS/2-based network operating systems competing.

PC came to mean all sorts of machines based on Intel or compatible CPUs running DOS or compatible operating systems.

Now, even that definition is getting broader. Sensing that DOS is nearing the end of its evolution, many computer users are looking at new choices, such as Windows NT, OS/2, or many of the flavors of Unix that are now being introduced for the Intel architecture. A number of vendors are introducing computer platforms that use new RISC-based CPU designs and portable versions of Windows NT or OS/2. Even within the Intel architecture, Intel itself is incorporating many RISC con-



*RISC-influenced superscalar CPUs
and portable 32-bit operating systems
are changing the PC's image.*

Michael J. Miller

cepts, such as executing multiple instructions in a single clock cycle, in its new Pentium chip. All of these machines are being designed to take industry-standard components, such as video systems and disk drives, because they're remaining competitively priced even as they increase in complexity.

In the second half of the '90s and on into the beginning of the next century, PC is destined to mean machines based on incredibly fast RISC-influenced, superscalar CPUs running portable 32-bit, multitasking operating systems.

NEW WAYS OF WORKING

This sounds like a lot of computing power, and it is. Don't worry about how we'll use it, though. Applications always grow to stretch your hardware's capabilities. I expect we'll see advances in lots of areas, focusing on three major trends:

The first of these is the most general: User interfaces are going to get a lot better. We've already seen progress in the transi-

tion from character-based programs using function keys to graphical programs with icons and pull-down menus. But that's just the tip of the iceberg. We're seeing programs designed from the ground up to be easy enough to use without opening a manual. The help isn't contained within a book, inside the box, or even in a separate menu system, but on-screen at all times.

Multimedia will play a large role in the evolution of the interface. I expect you'll see computers use audio, video, and animation to give help (Microsoft and Lotus have already started to do this), and as features of the user interface. Alternate-input technologies will also play a part. From handwriting recognition to voice recognition, from pen-based computing to devices that combine the functions of computers, telephones, and televisions, the potential is enormous. These applications will require lots of computing power, and will stress even the next generation of computers.

The second major trend is a move toward more personalized software. Applications will be very customizable, and you'll be able to link them together like building blocks. Macro languages that work across platforms will control these combined ap-

plications. Wizards and agents, which are application-specific today, will automate tasks involving multiple apps tomorrow. Many will run in the background—you may not even know they're there. These too will require powerful operating environments and platforms in order to work.

Third, in the future you will be able to get any information you want, wherever and whenever you want it. You will likely have software that automatically connects you to multiple information sources, from your company's proprietary database to generalized news services to personal electronic mail. Your e-mail and data files may well be sorted and prioritized according to filters that you have preselected. You will be able to be "connected" at the office, at home, and on the road—through desktop computers, laptop computers, and tiny, specialized personal communicators.

Our definition of the PC has broadened immensely over the past dozen years—and it's likely to keep expanding until it covers everything from hand-held electronic personal assistants to consumer information devices to fault-tolerant servers capable of handling thousands of simultaneous users. The PC is entering a new world. □



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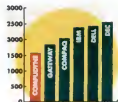


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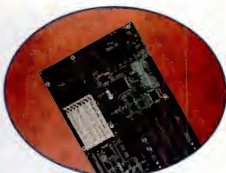


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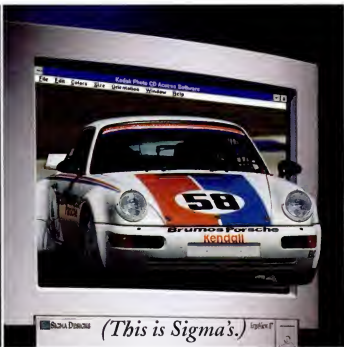
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Bill Machrone

Getting Organized

When the going gets tough, the tough go shopping. Things have been tough around the house lately. No, not domestic turmoil, just computer systems. Aside from the usual hassles, we've been going through the travails of trying to build

a decent local area network between the kids' and the grownups' computers. That's another story, though.

Our more immediate interest was coordinating that most suburban of concerns: our busy schedules. Between my travel, the kids' activities, and my wife's organizations and obligations, the calendar was, by turns, confusing, unreadable, and wrong. My wife, Sharon, asked me, "Can't you put this on the computer?" Normally, the correct answer is a resounding "No!" Putting simple, everyday tasks on a computer is usually a guarantee that you'll make them slower, unwieldy, and inflexible. The family calendar was so far gone, however, that anything would have been an improvement.

The market for calendar and scheduling software is not huge, especially below the level of project management and workgroup scheduling. You don't turn to Borland, Lotus, or Microsoft for this kind of thing. I suspected I would find something in the shareware market. I limbered up my 9,600-bps modem, logged onto ZiffNet, and perused the ASP (Association of Shareware Professionals) libraries. Each program has a short description, which you can read without downloading the entire file. I downloaded a bunch of candidates, then settled in for a long day of poking and prodding.

I started with the simplest, smallest program (it's an old prejudice), QuikDate. With a registration fee of only \$18, this one wouldn't damage my pocketbook too badly. But QuikDate's powerful capabilities in entering events (every Wednesday, fourth Monday, and so on) were marred by its inability to print a standard calendar. It prints only daily memos—no help when you want a single piece of paper that you can stick on the refrigerator door.

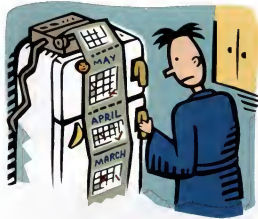
My next candidate was CalendarWise, another DOS program. With a registration price of \$29.99, it offers some nice features, including the key one for our purposes: printing monthly calendars. Its biggest weakness, however, is printing, since it uses your printer's standard fonts and depends on you to put the right codes in the printer file to choose font and font size. It comes with several preconfigured printer drivers that you can modify. The monospaced, nongraphical output was functional but less than lovely.

Next in line was Almanac, a Windows-based product with slick graphics and powerful features. Being Windows-based, Almanac had an almost unfair advantage over the DOS programs. Windows knows all the innermost secrets of your printer, comes with a variety of fonts, and gives you great flexibility.

Almanac is rich with features, including the ability to make the monthly calendar your Windows wallpaper. It uses overlays to insert holidays and other days of note. Of these, you have several choices (Jewish, Christian, USA), and you can edit them or create new ones. The monthly calendar display is limited to two lines of one

entry or two single-line entries. Almanac gives you a prioritized to-do list with automatic carryover and deletion, a daily schedule that shows holidays from the overlay, items you've entered, and the ability to append notes. The event editor gives you complete control over repeating appointments, allowing you to specify days of the week or specific time intervals, such as every n days, n th day of the month, n th day of the week, and so on. The printout of the calendar looks downright impressive.

I loaded up some sam-



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Bill Machrone

ple events and showed my wife the printout. Her response: "Hm." Spousal "hmms" can mean many different things. This was one of the good ones. At \$49, Almanac won't break the piggy bank, either.

SHOP TILL YOU DROP

Then we went shopping. We needed some supplies from Staples, and more memory for the HP LaserJet 4, and I wanted to stop by Egghead Software to check out the newest sound cards, since the one I owned had caused my Gateway 486 DX2/66 to roll over and play dead. Passing the Windows software display, I happened to see PowerUp's Calendar Creator Plus for Windows. According to the blurbs on the box, the software seemed to do everything we wanted and then some. The "and then some" was more than I could have hoped for, because Calendar Creator Plus comes with a library of clip art and a nice management tool, the Power Album. Earlier in the day, Sharon had asked if we had any clip art suitable for the elementary school newsletter she was working on. At the Egghead price of \$57, this struck me as a flat-out bargain. (Okay, I probably could have done even better by mail order, but sometimes you have to be impulsive.)

When we got home, I installed Calendar Creator Plus and fired it up. What a treat! It was as if they had taken the best features from all the other programs and added a few of their own. Entering events is blissfully simple, and you can assign them to specific days by dragging your mouse across them. A QuickDate dialog box gets you to any date in a hurry, and aids data entry. Calendar Creator maximizes its use of Windows by giving you item-by-item control over font, size, and style. The clip art sizes itself to the boxes, the text wraps around the art, text strings and titles are fully customizable, and the resulting printout is gorgeous. You can use the numerous standard styles, or create your own by modifying the abundant settings. You can print on standard organizer filler paper or create your own personal pocket calendars, called InstaBooks. I could go on, but you get the idea. This is a feature-rich product.

Given all the things this program can do, my mind is already percolating with applications. A calendar program may not change our lives, but at least our chaotic existence will be well documented. □

88 PC MAGAZINE JUNE 15, 1993

AMAX 486DX2/50 ISAmx Power Station



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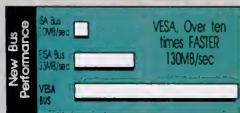
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CIRCLE 125 ON READER SERVICE CARD



John C. Dvorak

BIOS, BIOS, Who's Got the BIOS?

It's this BIOS thing that keeps bugging me. As I see the dead end of the PC architecture approaching, either something must be done or we will move on to the Power PC, the Digital Alpha, or some MIPS machine. First I chided the industry

about it, then Microsoft, then Intel. It was last night when I woke up in a cold sweat after reading (in my dream) an incredible ad.

Maybe this is getting tiresome, but let me recap the problem. The BIOS, which controls the I/O of the PC, dates back to 1983 and limits the machine to a minimum configuration of serial and parallel ports. It will only talk to a few disk drives and has no clue about SCSI or anything new. This means incompatible or flaky device drivers have to be user-installed to make these new peripherals work, and they only barely work, if at all. SCSI is a particular nightmare for some users.

So here's my dream. It starts with this ad:

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In the dream I was somehow transformed into a reporter asking for comments on the potential of this new chip. One guy from a research firm said, "IBM is back to its old tricks, trying to make everything proprietary." An ex-IBMer working for a Korean clone company said, "It's too cheap, and IBM will drop it in a month." A third fellow said, "IBM is wasting its time, and besides that, the Power PC will do all these things better."

That's when I woke up and realized my dream of a new BIOS—despite the potential market—may be a pipe dream foiled by the industry's historical neglect of its installed base. Why should things change? When the Power PC (or whatever new platform) arrives, the owners of the old machines will be left in the dust just as the owners of CP/Ms and Apple IIs were left in the dust. Still, the SuperBIOS is a great idea.



I had a weird dream about IBM's upgrade on a chip. It was called SuperBIOS, and it was hot!



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Inside Track

Is **Windows NT** part of a **grand scheme** to derail the competition? That's the conclusion I've drawn after a few **rumors** and a couple of facts passed across my desk.

The first rumor was that **IBM plans to build its own Pentium** and a line of optimized x86 chips using that old license from Intel it obtained when it was part-owner of Intel. An industry insider said to me, "IBM has finally figured out that Intel and Microsoft are its enemies." Microsoft, maybe—but Intel? Hmmmm. I then remembered how over the years **Microsoft has been closely involved with Intel**. Bill Gates once bragged about how Microsoft nearly designed the 286 for Intel. The companies are very tight, but this hasn't been publicized much recently.

The next thing across my desk was *The Microprocessor Report*, which said the **Pentium** is just catching up with the **R4000**, a two-year-old design from Mips.

Then came a report of NT's rumored **poor performance**. A guy with the latest beta alleges that the following statements are true: 1. Microsoft recommends a 25-MHz 386 processor, 12MB of memory, and at least 75MB of disk space just to get NT up and running! The system files alone take 50MB of disk space. 2. Performance of NT Beta2 stinks: DOS under NT is 5 to 25 percent slower than DOS under Windows 3.1, and Windows under NT is 20 to 30 percent slower than Windows 3.1. 3. Windows 3.1 apps are **non-preemptively scheduled** with respect to each other (you get cooperative multitasking only, just as in Windows 3.1). 4. When NT runs on RISC systems, it goes through a 286 emulator, and that means you get **Standard mode only** (no Enhanced mode Windows applications will run). 5. There's no support for Remote IPL (i.e., no diskless workstation support). 6. MS-DOS graphics applications **must run full-screen** on the x86 platform. 7. 16-bit Windows 3.1 drivers are not supported.

None of this surprised me except running NT on a **RISC via 286 emulation** since I was under the impression that NT was going to be ported to RISC, not run through an emulator—yuk! Then again, this may **all be bogus**, and NT is actually the **perfect operating system** that all the magazines say it is, sight-unseen. It just seems like a long time coming.

This "long time coming" thought was in my mind as I read about the **Digital Alpha chip coming out in a 200-MHz version**. Where the heck is the 150-

I've been wondering...

Does Microsoft really

want Windows NT to

succeed? Is NT real, or

is it just a smoke screen

to advance Microsoft's

marketing goals?

Conspiracy theorists,

get to work!

MHz version? By the time Digital starts shipping this Alpha machine in quantity, it'll be the turn of the century. **What's the delay?** Well, Digital is banking on NT, and so are the MIPS people.

The icing on the conspiracy cake came when Microsoft said it was working on **Windows 4.0** and **DOS 7**—both 32-bit standalone operating systems. Windows 4.0? Why bother, if NT is this killer diller be-all and end-all OS?

Finally the **light bulb lit!**

Does Microsoft really want NT to succeed? Is NT real? Or is it just a smoke screen OS to accomplish two marketing goals: 1. To keep Microsoft's buddy, Intel, in the driver's seat (until Intel can catch up to RISC designs) by **forestall-**

ing the RISC makers with promises of a crossover OS. Why should Microsoft want to fragment the market by supporting Digital Alpha and the MIPS RISC line? That would mean it would have to port products to unknown, complex platforms. If nothing else, it would be easier to support, say, Excel running on Intel-only platforms than Excel running on a half-dozen different RISC machines with oddball displays and I/O. The cost of porting and support would eat into profits. It would make no sense for Microsoft to risk its dominance by encouraging market fragmentation. But if NT were just a red herring, then it would make sense.

2. To **forestall OS/2 gaining market share** on Windows. NT serves the useful purpose of becoming the carrot in front of the donkey until Windows 4.0 comes along. Most Windows users expect that NT will be the next great operating system because Microsoft told them it would be. And, gee, it looks great on paper! And most beta-testers say it works fine, too. But why are we hearing talk about Win 4.0? All the talk about future products does a wonderful job of keeping the Windows users (and developers) in line.

There are a lot of different ways this can go. Remember how quickly Microsoft **pulled the plug** on its version of OS/2 with denials up to the last moment. Is it possible that Microsoft would do the same with NT? There's plenty of good technology in NT that can be incorporated into Windows 4.0 and targeted to Intel-only platforms. The vast majority of users won't care about NT if Win 4.0 is feature-laden and fast.

I'm sure that a few incomplete versions of NT will be released. One version should be out as you read this. There were a couple of OS/2 versions by Microsoft, too. Have you noticed how companies find a **formula for success** and then keep repeating it? □

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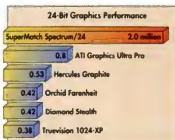
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CIRCLE 127 ON READER SERVICE CARD



Jim Seymour

PC Sound: Eight Isn't Enough

I've spent the past six to eight months immersed in the arcana of PC multimedia. Animation on a PC screen is intriguing, whizzy slide shows are impressive, and interactive multimedia is going to be extremely important. Those are the immediately

impressive technologies, the facets of multimedia most seductive for writers and PC users alike.

But underlying these attention-getting techniques is a simpler but equally vital medium: sound. And despite huge advances in PC sound, too many users still think of sound as little more than the *whooshes*, *clanks*, and phony laser *pinngggs* behind computer games.

The huge, quick success of the Creative Labs Sound Blaster card contributed to that reputation. Game makers started paying a lot more attention to the audio in their packages, to the point that producing the "sound track" for a new PC game these days has become as complex as creating a hit on the pop charts—or harder, since the result must be packed into a very tiny block of digital-sound code.

But there is life after Sound Blaster, and there are worlds of useful applications for PC sound beyond computer games.

I've talked often about my affection for what Compaq and Microsoft call "business audio." That's basically the lowest level of interactive PC audio: You can record and play back sound on your PC. Business audio is enormously useful for such things as adding voice annotation to documents and spreadsheets, and I use it often.

It's relatively easy to choose the right hardware and software tools for business audio. The Microsoft Windows Sound System is very good, and Logitech's AudioMan parallel-port system is great, especially for slotless notebook-PC users. There are a few other good options, such as Orchid technology's Fahrenheit VA-series video cards, which add voice-annotation support to their primary video-display function.

The problems come when you begin to reach beyond simple voice annotation, which requires little more than 8-bit hardware, a microphone, and inexpensive speakers. Dealing with the puzzling world of more-capable 16-bit audio cards, mono versus stereo, and speakers and amplifiers up to the standard of 16-bit PC audio can be frustrating. Expensive, too, if you buy less flexibility and performance than you need, and have to trade up too soon.

Let me share four rules of thumb, gleaned over 20 years of producing and showing conventional multimedia presentations with their associated sound tracks, and several months of immersion in PC multimedia issues.

Eight Isn't Enough. Simple 8-bit PC sound systems are fine for audio annotations, or for playing back what I would call functional audio from CD-ROMs—instructions for using a new program, for example. And relatively primitive 8-bit sound is perfectly sufficient for some special purposes, such as learning a language, as with the little sound dongle in the wonderful Power Japanese software package.

But for anything more professional, you want 16-bit sound—often called CD-level sound, because at its best it approximates the sound quality of audio CDs. New 16-bit cards, such as the Sound Blaster 16 ASP or the Media Vision Pro AudioSpectrum 16, are capable of vastly better sound than the first- and second-generation 8-bit cards.

Mono Isn't Enough. Most low-level PC sound work, such as voice annotation, is in mono and works fine. But beyond those simpler uses of PC sound, you want stereo. Even if there isn't much stereo sound in the originals you're dealing with



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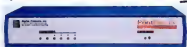
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Jim Seymour

today, there will be tomorrow. Then you'll regret going for an old, mono-only setup.

Use a Realistic Sampling Rate. When you're recording sound, choose a sampling rate that's suitable for your CPU, and that strikes a balance between sound quality and file size. Sample rates available on PC sound systems typically range from around 12 kHz (telephone-line sound) up to 44.1 kHz (equal to audio CDs).

I've found that you can use up to 32-kHz sampling rates without problems on any 386SX or better platform, and with most faster 286s. Any PC using a 486 chip can handle the higher-quality 44.1-kHz rate.

Just because your PC can handle higher sampling rates doesn't mean you need to use them. Voice recording is fine at 8 kHz and better. And even music recordings sound very good at 32 kHz. I save 44.1 kHz only for really critical music mastering.

Why? Because file size increases rapidly as your sampling rate increases. Don't chew up valuable hard disk space in order to get sound quality you don't need.

Buy Good Speakers. I'll be discussing in detail the subject of speaker selection in the future, but simply put, you should get good speakers, and make sure you have enough amplification.

The speakers sold with many multimedia PCs are miserable. The best that can be said is that they cost the PC vendor so little that it's not too painful to throw them away.

You'll almost certainly need amplified speakers. Sound cards' audio output is just too feeble to drive respectable speakers, even with a card that boasts a "powerful, 4-watt amplifier!" The Altec-Lansing ACS300 PC-sound speaker system, at about \$300, including a compact, separate subwoofer unit, is very good. So are Acoustic Research's AR 570s, Bose Roommates and a few other units in that price range.

If you have a small stereo system in the room in which you use your PC, consider running your PC sound card's audio output into the stereo's AUX, CD, or TV jacks, or any other unused high-level inputs. You'll have plenty of amplification, and much better speakers than those connected to most users' PCs.

PC audio can be dazzlingly good. Almost any presentation—even a simple PowerPoint or Freelance slide show—benefits enormously from an appropriate sound track. □

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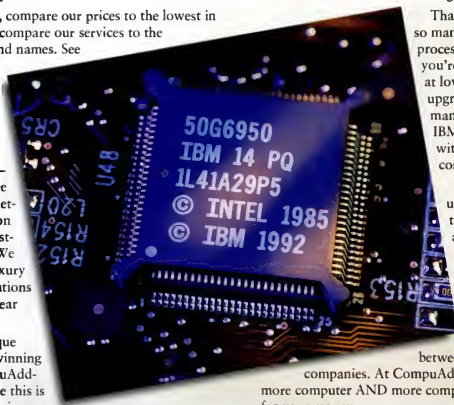
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Bill Howard

Laptop Buyers' Checklist

Businesses that buy portable computers in quantity have lots of buying experience now—experience of the sort a child gains by grabbing a boiling pot. In the past, buyers have been burned by settling for almost-good-enough portables. As

users trade in desktops for portables, they are less willing to buy compromised machines.

What are the must-have features for notebooks? My list is based on four assumptions: First, the world is going to Windows. Second, Windows is a performance pig. Third, monochrome graphics just doesn't cut it for Windows. Fourth, add-ons (pointing devices, high-speed modems) should be built-in. Here's the checklist:

- **486 CPU.** Clock tick for clock tick, a 486-class CPU delivers twice the performance of a 386, but the cost of a 486 system is only \$250 more. Don't scrimp unless you know you won't use Windows at any point during the life of your system—between now and, say, 1996.

- **Built-in pointing device.** Let's be blunt: All built-in pointing devices are pretty terrible, but they're always there for you. When you're on the road or in transit you'll use the built-in pointer, but when you're back in the office, plug in a real mouse. Sorry, but clamp-on trackballs, such as the Microsoft BallPoint Mouse and Logitech's TrackMan Portable, are too clumsy, and Microsoft's QuickPort, the no-cable version of BallPoint, is too little, too late. (Note: Preference in built-in pointing devices is very personal. That said, I believe more users prefer the IBM Trackpoint II, a mini-joystick between the G and H keys, and the Apple PowerBook, a front-mounted trackball.)

- **PCMCIA slots (plural).** For all their faults (and there are many), those credit card-size PCMCIA sockets are going to be the way to add modems, memory, flash memory, LAN cards, wireless communicators, and small-capacity removable hard disks. Get a system with two sockets unless you want to remove your modem every time you hook up your network

card. Look for the larger sockets, particularly Type III (10-mm height) and the unrattified Type IV (17-mm height). Why? Some devices won't be compact enough to fit in a Type II slot for two or three years.

- **Color display.** A mediocre color display is better than a good monochrome one, but I suspect companies will split their purchases between the two. Users who have notebooks as primary machines and who run Windows a lot will get color systems. Those who run Windows occasionally will get monochrome notebooks: They'll save \$500 to \$1,500 and a pound of weight, and they'll gain up to an hour of battery life and a thinner display.

- **200MB hard disk.** You probably wouldn't settle for 120MB on the desktop. Heat-seeking users should watch for the 340MB systems coming soon. That's right: 340 megabytes from a two-platter, 2.5-inch disk drive. Ain't technology grand?

- **Docking station.** A docking station will free you from fumbling to make half a dozen connections each time you return to your office. It can hold a fast video card and an inexpensive network card, and can be a security cradle. If all you need are the cable connections, look

for a port replicator. If you plan to stay loyal to one vendor, get a commitment to compatibility with future models.

Those are the must-haves—as distinct from the nice-to-haves, such as eight (not four) cursor control keys, upgradable screens, and removable floppy or hard disks. What if you don't want all these features and all this functionality? Be thankful for those who do: They'll drive down prices of less desirable systems living below the technology curve. That's why you can buy a 6-pound 386 notebook for \$999 today. □



Your next notebook should have a 486 CPU, a built-in pointing device, PCMCIA slots, and a color display.

Read my

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READERS' CHOICE
AWARD
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April 14, 1992
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GRAPHICS

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Speed. Simplicity. And accuracy were all applauded. It's no wonder. HP's single-pass scanning delivers both lightning-fast speed and precise color registration. TWAIN support allows scanning without having to switch between applications. And HP AccuPage technology with 400-dpi resolution can tackle the toughest OCR challenges. What's more, capabilities this advanced are now even more affordable. List price on the HP ScanJet IIC has just dropped to \$1,599. The HP ScanJet IIP is just \$879.

Impressed? Don't just take our word for it, or even the PC press's. Attend one of our scanning seminars that will be held April through September, 1993. To find out more about the HP ScanJet IIC and IIP or seminars in your area, call 1-800-SCANJET, Ext. 7365. And judge for yourself.



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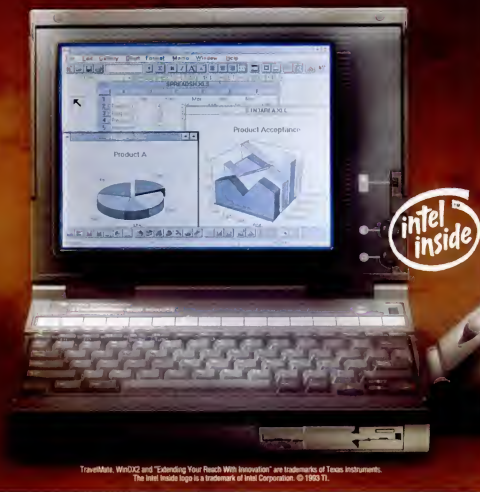
— PC Magazine, Mar. '93

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— Portable Computing, Apr./May '93

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— Windows Magazine, Feb. '93



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The New PCs

BY MICHAEL J. MILLER

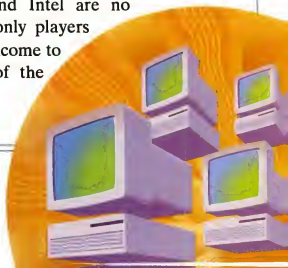
Say good-bye to the PC as we have known it. Good-bye to DOS. Good-bye to a world of only Intel-compatible CPUs. Good-bye to the architecture IBM introduced in 1981.

We are destined for a future that includes portable, 32-bit, multitasking operating systems running on incredibly fast, RISC-influenced, superscalar CPUs. In this issue, we take a look at the building blocks of the PCs of the future, from alternative hardware platforms to emerging operating systems.

New platforms will compete with the dominant 486 architecture and Intel's new Pentium processor. The Apple Macintosh Quadra 800, Digital Equipment Corp.'s Alpha AXP PC, Hewlett-Packard Co.'s Precision Architecture (PA)/RISC chip, the IBM RS/6000 PowerStation 365 (the predecessor to the PowerOpen architecture IBM is developing with Apple and others), and

the Sun SPARCstation LX bring new levels of performance and new capabilities in PC-style boxes at PC-style prices.

Microsoft's DOS just got a major update, but many users are looking beyond DOS to 32-bit multitasking alternatives. Unix has been around for a long time, but it's getting brand-new respect on the Intel platform with products such as NeXTStep, SCO's Open Desktop, Sun's Solaris, and Univel's UnixWare. Other advanced operating systems are coming too, and we take a long look at the upcoming Windows NT and the release of OS/2, Version 2.1. All of these promise new capabilities while preserving compatibility with existing standards. Will they succeed? Only time will tell. But welcome to a world where Microsoft and Intel are no longer the only players in town. Welcome to the world of the new PC.



WORKSTATION PLATFORMS • Heavyweight Contenders

PC Magazine sends a Pentium-based Compaq workstation into the ring to do battle with five industrial-strength workstations from Apple, Hewlett-Packard, IBM, Silicon Graphics, and Sun.

by Don Crabb

A year ago, we set out to compare the hottest PC we could find (at the time, an Intel 486/50 EISA-based machine; we used a Dell PowerLine 450DE) against three hot desktop workstations—a NeXTstation Turbo Color, a Sun SPARCstation 2GX, and an Apple Macintosh Quadra 700. Our conclusions: Despite the sheer computing prowess of the workstations, we preferred to stick with our PCs because they enabled us to do more of our business computing faster (and because of the variety of applications that were available on DOS/Windows PCs, as well as our familiarity with the platform).

A year later, we've decided to run this comparison again, but to up the ante. Last year's Dell has given way to an even hotter PC—a Compaq Deskpro 5/66M Model 510 with the new Intel Pentium CPU. We tested the Deskpro 5/66M with DOS and



ght



a version of Unix (so we could compare its performance versus Unix workstations). Last year's Quadra 700 has been replaced by the faster Quadra 800. The SPARCstation 2GX has been superseded by the less expensive, more mainstream SPARCstation LX, which includes GX graphics acceleration for its targeted PC users. The NeXT is no longer with us. After the company quit the hardware business in February, we dropped the 33-MHz 68040 Turbo Color machine from our tests.

In order to make up for this loss, we set our sights on a new pack of desktop workstations, all sporting hot RISC CPUs and running some variant of Unix. The new test subjects included the Hewlett-Packard HP Apollo 9000 Model 715/50, an IBM RS/6000 PowerStation 365, and a Silicon Graphics Iris Indigo R4000 XZ.

WHY DO YOU BUY A COMPUTER?

There is a tendency among the computing faithful to believe that their computers are the best around. Regardless of whether you're a lover of PCs, Macintoshes, or workstations, you probably tend to extend reality a little bit when it comes to seriously evaluating your true love. In this article, we have attempted very hard to push aside our PC bias (after all, this is *PC Magazine*), as well as our Macintosh and workstation biases. In short, we have tried to answer a very simple question—Which computer should you buy?—by testing each of these machines with real-world and laboratory tasks.

The simple truth is that you don't really buy computers (or you shouldn't), you buy computing solutions. By that we mean you buy software that will do the tasks you want done in as efficient a man-

ner as possible. The computer only becomes important after you have picked the software you like best (because it fits your needs, the way you work, and your budget). The computer, in that scenario, is nothing more than the device that can run the software.

The problem, of course, is that not all computers can run all software. Thanks to the proliferation of competing operating systems, we find ourselves confronted with a mountain of software that runs only on specific machines, running specific operating systems with specific hardware configurations. So our hope of buying computing solutions (software) as though the platform didn't matter has been stymied.

Instead, when we buy applications, we have to be extra careful that the version we like is the one that will run on our machine. Even software that purports to be cross-platform-compatible can only be identical to the degree that the underlying operating system (and graphical user interface) allow.

In order to take these types of software differences into account during our

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HIGHLIGHTS

PC Platforms

BOUNDARIES are blurring among the Apple Macintosh, Intel-based desktop PCs, and Unix workstations using RISC-based CPUs. The traditional PC can now run robust operating systems, and traditional workstations can use operating systems that run mainstream business applications.

WINDOWS NT runs on the PC and on some RISC workstations, meaning users seeking a powerful successor to DOS and Microsoft Windows have a wider choice of CPU platforms. Speedy RISC workstations have adopted graphical interfaces that hide the underpinnings of Unix.

IN THIS ARTICLE, we test the Pentium-based Compaq Deskpro 5/66M Model 510, the Apple Macintosh Quadra 800, the HP Apollo 9000 Model 715/50, the IBM RS/6000 PowerStation 365, the

Silicon Graphics Iris Indigo R4000 XZ, and the Sun SPARCstation LX. We also discuss Digital's Alpha AXP PC and the IBM-Apple PowerPC.

EDITORS' CHOICE wasn't awarded because so much depends on your intended application. We did rate the six systems on their suitability to task for six environments: application development, connectivity, engineering, DTP, 3-D graphics, and general office productivity.

IN TESTS under Unix, the Pentium chip performed roughly on a par with midrange RISC systems on integer tests. On floating-point tasks, however, the RISC systems were on the order of twice as fast. The Unix RISC workstations will also stand out for networked application development and for SQL databases.

AMONG THE RISC workstations that we tested, the HP, IBM, and SGI machines each showed particular strengths. The SPARCstation LX lagged (even behind the Compaq machine), but it isn't Sun's most powerful unit. With the Pentium, the PC now has a CPU that holds its own.

THE MACINTOSH user interface is the best of the bunch. But the Mac is out of its league when it comes to performance. On some graphics tests, the PC was an order of magnitude faster.

PRICES RANGED from \$7,500 (Compaq) to more than \$30,000 (Silicon Graphics). The level of equipment clearly affected its price and performance. The Compaq was the overall price-performance leader, while the HP (\$17,240) offered the most bang for the buck among RISC PCs.

evaluations, we attempted to test cross-platform applications (to give us some sense of how the "same" application fared on different platforms) as well as platform-specific applications that take special advantage of the hardware and operating systems of the test machines (to show any special advantages particular platforms might have for accomplishing certain computing tasks).

WELCOME TO OPEN SYSTEMS

Today we see a desktop-computing world dominated by PC/DOS machines. We also see another strong desktop world controlled by the Apple Macintosh. In addition, we have an odd desktop workstation market with its reliance on Unix, an operating system we've been told is "difficult."

A potent threat to Intel's dominance of the PC-processor market is coming from several RISC-processor vendors.

What if we were to tell you that, within a year, all of this was going to change? The truth is that the convergence of operating systems and RISC-based CPUs is shaking the foundations of the traditional desktop computing world. By the middle of 1994, we will have affordable, extremely powerful desktop computers that are capable of running multiple operating systems (some in native mode and others in emulation), and thus are capable of running different GUIs and almost every desktop application you can buy.

The players in the operating system convergence game include Microsoft with Windows NT, its first unified OS/GUI version of Windows; various vendors' versions of Unix that are based on the AT&T and Open Software Foundation (OSF) System V, Release 4 (SVR4), standard; IBM's OS/2; and the Apple-IBM-Motorola PowerOpen system.

Each of the competing operating systems will offer full 32-bit data path compatibility with their CPUs (which im-

Suitability to Task

All of our Suitability to Task ratings are based on comparisons of the relative merits of all the units we reviewed.

The HP Apollo 9000 Model 715/50 did well in every category, receiving top scores as an applications development machine and engineering workstation. Its X11 library graphics accelerator was by far the fastest in the group. The IBM RS/6000 PowerStation 365 also ranked highly. But bear in mind that the PowerStation 365, in its tested configuration, cost \$6,195 more than HP's offering. The PowerStation 365 fell short only in office productivity; the availability of office productivity software was more restricted than in the case of the HP Apollo 9000.

The Apple Macintosh Quadra 800 suffered in comparison with the more robust systems in this review. We judged it outstanding in only one category: desktop publishing. And it was only the Mac's wealth of innovative DTP software and the widespread acceptance of its output formats that drove that score up.

The Pentium processor in the Compaq Deskpro 5/66M Model 510, on the other hand, signals the arrival of the Intel x86 family. The Pentium, with its excellent floating-point performance and enhanced internal processor caches, gave the PC the power to compete in domains previously reserved for midrange workstations.

The Silicon Graphics Iris Indigo R4000 XZ was easily the most popular machine at PC Magazine Labs during its stay. Demonstrations of ElectroGIG USA's 3D Go were breathtaking; the ease with which three-dimensional objects can be manipulated in real time is a testimonial to the unit's graphics subsystem.

Applications development scores are based on the availability of a wide variety of compilers and debuggers, ease of coding for the platforms' supported operating systems, and raw compile speeds under FORTRAN and C, as measured by Workstation Labs (WSL).

Connectivity scores are based on the ease of communications in homogeneous and heterogeneous

proves overall performance), preemptive multitasking (which enables you to run multiple applications intelligently), protected memory (which prevents one misbehaving application from causing the entire system to crash), and built-in scalable networking.

A potent threat to Intel's dominance

SUITABILITY TO TASK

Product Name	Score			
	Good	Fair	Good	Excellent
Applications development	●	●	●	●
Connectivity	●	●	●	●
Engineering/scientific/2-D CAD	●	●	●	●
Desktop publishing	●	●	●	●
3-D graphics	●	●	●	●
Office productivity	●	●	●	●

environments, the ease of communications in a DOS networked environment, the ability to read and write DOS files directly, and the ability to run DOS (emulation) sessions.

Engineering/scientific/2-D CAD scores are based on each system's performance on low-level floating-point tests (SPECfp92, Stanford Floating-Point, and Whetstone tests), graphics tests, and CAD tests (San Diego AutoCAD Users Group tests), as well as other tests that were administered by Workstation Labs.

Desktop publishing (DTP) scores are based on the availability of a variety of DTP software and output options, graphics performance, application performance (for the Quadra 800 and Deskpro 5/66M only), and overall system performance.

3-D graphics (animation and modeling) involves some of the most demanding tasks a system can perform. Graphics acceleration, floating-point performance, multiprocessing capacity, and overall system performance were all factored into the ratings for this category.

Office productivity is a catch-all category involving some of the more common tasks that might occur in an office environment, such as word processing, spreadsheet analysis, creation of business presentations and forms, data entry, e-mail correspondence, and scheduling. Highly rated platforms support a variety of applications within each category and ideally allow smooth integration of all of the various tasks.

of the PC-processor market is coming from several RISC-processor vendors, including Digital Equipment Corp. and its 200-MHz Alpha chip, on which Windows NT will run (for more information, see the sidebar "Preview: Alpha AXP PC"). Apple, IBM, and Motorola will be putting forward their multiple OS desk-

THE KITCHEN SINK IS

Our T4500C features an LCD TFT active matrix color screen that can display a kaleidoscope of 256 simultaneous colors from a palette of 185,193. Our T4500 offers a large, bright, easy-to-read 9.5" VGA display with 640 x 480 resolution and 17:1 contrast ratio.

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The T4500's dimensions: 11.7"W x 8.3"D x 1.8"H.

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Windows® 3.1 and DOS® 5.0 with Ultrafont™ come pre-installed.

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Our Quick Charge capabilities allow you to charge the battery while you're working.

Featuring AutoResume, AutoSave, Advanced Power Management, and CPU Sleep Mode, our MaxTime™ power management system helps you get the maximum out of every battery charge.

Quickread LCD status icons allow you to check a host of functions (including remaining battery time, keyboard status, and power-saving mode) at a glance.



An industry-standard PCMCIA 2.0 slot accepts removable hard drives, data/fax modems, network adapters, and other expansion options.

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A front-loading floppy drive provides easy access.

Both the T4500 and the T4500C weigh in at about 6.5 lbs.



The T4500 features a large, easy-to-read 9.5" monochrome screen.



Tests reveal that the 3.3-volt 20MHz i486™ SX processor is up to two and a half times faster than many 386-based notebooks.



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top solutions based on the PowerPC chip. Sun Microsystems (using its next-generation SPARC 3 CPUs) and Hewlett-Packard (using a slimmed-down version of PA/RISC) also are in the race. Several other vendors (Including Acer and startup DeskStation Technology) are fielding systems based on MIPS R4000 and R4400 RISC chips that also will run Windows NT. Confusing, you say? Let's try to sort out all the information.

WHAT'S IN AN OS, ANYWAY?

Operating systems are obviously the control programs of modern desktop computers. To run applications, you must have an operating system that controls the hardware, provides a file system, and provides a unified interface for general computing housekeeping duties such as file copying, renaming, and deleting.

DOS-based PCs use a version of the venerable (and quite simplistic) Microsoft Disk Operating System (DOS), typically with the Windows GUI layered on top. Windows NT will eliminate the need for the antiquated DOS underpinnings by providing a true 32-bit operating system that ties to the hardware directly and includes its own file system and the Windows GUI. For our application tests on the Compaq Deskpro 5/66M, we chose the most recent version of DOS (Version 5.0) running Microsoft Windows 3.1.

Workstation Labs, an independent testing facility well known in the Unix world, conducted the bulk of the testing for this review (Workstation Labs, 4324 North Beltline, Suite C-211, Irving, TX 75038; 214-570-7100). When Workstation Labs tested the Pentium-based Deskpro 5/66M against the RISC workstations, it did so by running a version of Unix from The Santa Cruz Operation (SCO), called SCO Unix 3.2, Version 4.0, running Open Desktop 2.0.0.

Each of the midrange workstations we tested ran a variant of the AT&T SVR4 standard: The SPARCstation run Solaris 2.1 and OpenWindows 3.1, the Indigo XZ

ran Irix 4.0.5F, the HP Apollo 9000 ran HP/UX 9.01, and the PowerStation 365 ran AIX 3.2. We did not test the Quadra 800 with Apple's version of Unix (AUX 3.1) because so much of the Macintosh's performance comes from Version 7.1 of its Macintosh System Software (System 7.1). We used this operating system for applications testing.

The performance tests run by Workstation Labs strove to eliminate as much as possible the variations caused by the different versions of Unix, and to get a handle on the actual hardware performance of the machines. But we could only go so far with that line of testing, because when you buy any workstation, you are inevitably buying that machine's version of Unix.

WHAT IS UNIX?

Unix had a single inventor, AT&T Bell Labs, which has maintained its influence on successive

versions since the operating system first appeared in 1969. In 1989, AT&T created Unix Systems Labs (85 percent is owned by AT&T), which licensed its Unix versions to vendors. The other prime mover of Unix, The University of California at Berkeley's Division of Electrical Engineering and Computer Science, has had nearly equivalent influence over Unix (releasing modified Unix versions called the Berkeley Standard Distributions, the most recent being BSD 4.3). Novell recently purchased Unix Systems Labs from AT&T (and the rights to Unix) for \$360 million, which could lead to the development of a unified Unix version.

Another development that could increase the acceptance of Unix has been the blending of the AT&T SVR4 and

Berkeley (BSD 4.3) versions by specific hardware and software manufacturers to produce Unix versions containing highlights of both systems. To help foster versions that could be adapted by more manufacturers, several industry groups (such as the Open Software Foundation [OSF] and Unix International [UI]) have created specifications for a "standard" Unix kernel. The kernel is the heart of any Unix implementation: It is the software that talks to the hardware at the most basic level.

Both OSF and UI are attempting to pare Unix down to two standards, which would be a significant achievement considering there were as many as 220 Unix versions in 1982. UI is centering its efforts around the AT&T SVR4 standard, while OSF/1 Unix (which currently emulates BSD 4.3) is being built around IBM's AIX core product (which is based on Carnegie-Mellon University's Mach operating system). The two standards are incompatible, but both contain a number of common elements.

Both OSF and UI have joined X/Open, an international consortium attempting to set a single Unix standard (most recently with its X Portability Guide). All three organizations (OSF, UI, and X/Open) are adhering to the Institute of Electrical and Electronic Engineers (IEEE) Unix standard called Posix. Politics has thus far prevented a single standard from being established, but with the impetus of Novell's ownership and the specter of Windows NT on the horizon, there's a growing possibility that rival vendors will endorse a single Unix standard in the 1990s. (As we go to press, HP, IBM, Sun, and other major Unix vendors have announced the formation of COSE [Common Open Software Environment], organized for just that purpose.) A unified Unix would make all Unix workstations more attractive platforms for the kinds of productivity appli-

Politics has prevented it thus far, but there's a possibility that rival vendors will endorse a single Unix standard in the 1990s.

Our Contributors: MICHAEL J. MILLER is editor-in-chief of *PC Magazine*. NICK STAM is a technical director (Hardware) at PC Magazine Labs. ALAN BUCK compiled and analyzed performance test results for PC Magazine Labs. DON CRABB is a director of laboratories and a senior lecturer at the University of Chicago. BERNARD J. DAVID is president of General Information Services. DANIEL TABAK is a professor of electrical and computer engineering at George Mason University. DAVID WILSON is the president of Workstation Labs. MICHAEL NEUBARTH was the associate editor in charge of this story, and JON HILL was the project leader.

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cations that we all take for granted on our PCs. Currently, particular applications run only on specific versions of Unix.

WHAT DID WE TEST?

Our test-bed PC was one of the fastest we could lay our hands on: a Compaq Deskpro 5/66M Model 510 using the new Intel Pentium CPU (also called the 80586), and equipped with an ATI Graphics Ultra Plus board for tests requiring 24-bit images and an EISA QVision video card for other testing. We chose this machine because of its overall speed, expandability, and high performance.

Against this hot PC, we stacked up mainstream platforms that you might be tempted to buy instead of a PC, especially in view of the new pricing realities that have arisen for Apple and other non-PC platforms during the last year. You can now buy a fully equipped workstation or high-end Macintosh for much less than the \$10,000 and beyond that such a machine would have cost in 1992.

The other players in our tests were the

HP Apollo 9000 Model 715/50, Hewlett-Packard's updated RISC-based workstation that picks up where the original HP Apollo series left off; the IBM RS/6000 PowerStation 365, a successor to IBM's first-generation RS/6000 RISC workstation; the Silicon Graphics Iris Indigo R4000 XZ, an update to the successful Indigo machine with much better performance and both GIO/64 and EISA buses; the low-end Sun SPARCStation LX, which served as a workstation counterpart to high-end PCs; and the Macintosh Quadra 800, Apple's latest 68040 high-end Macintosh that's based on the Motorola CPU running at 33 MHz.

HOW MUCH DO THEY COST?

The Quadra 800 was among the least expensive units tested. As equipped, the system is priced at \$8,690, including a 33-MHz 68040 CPU, 24MB of RAM, a 230MB hard disk, built-in Ethernet and SCSI interfaces, and a 16-inch Apple color monitor. System 7.1 came installed.

The Indigo XZ was the budget buster among the tested machines, checking in

at \$30,200 for a machine with 32MB of RAM, a 1.2GB hard disk, a 0.25-inch floppy disk drive, an internal CD-ROM drive, a 19-inch color monitor, and the XZ graphics subsystem equipped with 5MB VRAM, a SCSI interface, and built-in Ethernet. You pay another \$1,200 for a C compiler, and \$1,195 for a FORTRAN compiler.

The PowerStation 365 came in with a list price of \$23,435. For that price you get a machine with a 50-MHz IBM Power RISC CPU, 32MB of RAM, a 19-inch color monitor, a 1GB hard disk, a SCSI interface, and built-in Ethernet. You also get the AIX operating system (along with NFS support), a C compiler, and X Window included in the base price. A FORTRAN compiler will cost you an additional \$1,520.

The HP Apollo 9000 was cheaper than the SG1 or IBM machines. For a list price of \$17,240, it comes with a 50-MHz HP/PA 1.1 CPU, 32MB of RAM, a 19-inch color monitor, a SCSI-2 interface, a 1GB hard disk, built-in Ethernet, and the

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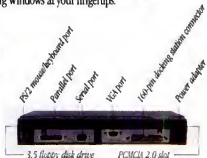
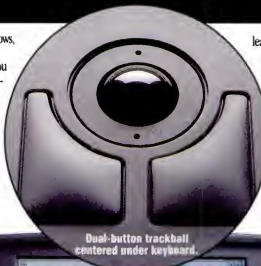
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HP/UX 9.01 operating system (including NFS support). Extra copies of the operating system cost \$415. Both the C and FORTRAN compilers are pricey: \$2,090 for the C development system, and \$2,095 for FORTRAN.

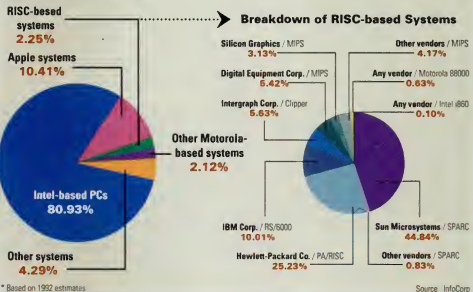
The SPARCstation was the cheapest of the midrange Unix workstations, costing \$10,395 (plus an additional charge for its 32MB of RAM) for a model offering a 19-inch color display with built-in GX graphics acceleration, a 50-MHz micro-SPARC CPU, a 424MB hard disk and a SCSI interface. The machine also included built-in Ethernet and NFS support. You must pay \$40 for the media containing the operating system, plus \$675 for a C compiler and \$999 for a FORTRAN compiler. For about half the price of the LX (\$5,495) you can buy the similarly equipped Sun SPARCclassic we tested, which lacks the GX graphics acceleration feature but constitutes a bargain in the world of Unix workstations.

The Deskpro 5/66M hadn't been formally priced at press time, but we expect it to list for about \$8,000 with a 66.7-MHz Pentium CPU, 32MB of RAM, a 20-inch VGA color monitor, a 360MB hard disk, and an IDE hard disk interface. Our test machine lacked built-in Ethernet and SCSI interfaces. When tested running SCO Unix 3.2, Version 4.0, the unit also lacked NFS, so we could not perform server network tests. If you were to run SCO Unix, you would need a larger hard disk (we recommend 1GB) because of the size of the SCO OS (about 300MB). Most Deskpro 5/66M's will ship with DOS 6.0 and Microsoft Windows 3.1 installed.

The problem in comparing the prices of these systems is that you receive different levels of accoutrements: different depth color monitors, different size hard disks, CPUs that range in speed from fast to extremely fast, and so on. The key to comparing workstations and PCs is to choose a PC configuration you want to live with, then ask your workstation vendor to price a comparable configuration. All things being equal, the overhead of Unix requires more RAM and hard disk space to run versus DOS, Windows, or even OS/2.

Market Share by Platform *

PCs are by far the leading platform, accounting for roughly 80 percent of all desktop units shipped worldwide in 1992. Sun Microsystems manufactured nearly 50 percent of all RISC-based systems shipped.



HOW DID WE TEST?

We tested the Unix machines by contracting with Workstation Labs (WSL), who verified the hardware and software configurations of each machine, then set about the laborious process of installing a suite of low-level testing programs on each machine. Because of the extreme performance hit the Quadra 800 takes when running Apple's AUX 3.1, Workstation Labs did not test the Quadra 800. More than 98 percent of Macintosh users run their

addition, we ran Stanford multiprocessing tests to gauge the multiprocessing ability of the machines, and an AutoCAD test that was developed by Chris DeLucchi of the San Diego AutoCAD User's Group.

Since we did not run low-level performance tests on the Quadra 800, we decided to compare the Deskpro 5/66M running Windows 3.1 to the Quadra 800 running System 7.1 with a series of applications tests. The test suite included word processing (Microsoft Word and Word Perfect), spreadsheet (Lotus 1-2-3 and Microsoft Excel), desktop publishing (Aldus PageMaker), and image rendering (Pixar's Typestry). This would

WSL ran an exhaustive series of performance tests on each Unix machine to determine its basic CPU, graphics, networking, and hard disk performance.

machines under System 7.1, which comprises a major portion of the Macintosh's value.

WSL ran an exhaustive series of performance tests on each Unix machine to determine its basic CPU, graphics, networking, and hard disk performance. These tests, which are summarized in our "How We Tested" section, included Dhrystone, Graphstone, Khmerstone, a SPECmark test suite, the pair of Whetstone tests, X11PERF, and Mandel and other floating-point and integer tests. In

help us evaluate the Mac's performance against the workstations because we had run most of the low-level tests on the Deskpro 5/66M running SCO Unix.

WHAT DID WE FIND?

Overall, the Compaq machine did well in applications development, connectivity, and office productivity. The Quadra 800 excelled at desktop publishing, and did less well at connectivity, 3-D graphics, and office productivity—although its scores for these tasks were still high. The

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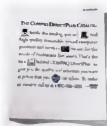
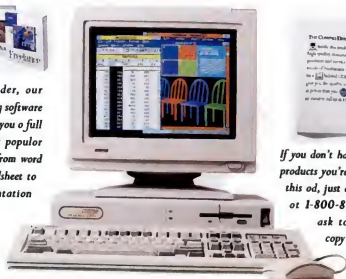


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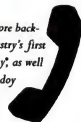
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IBM RS/6000 showed its prowess at applications development, connectivity, and engineering tasks, while the Indigo XZ shined at connectivity, desktop publishing, and 3-D graphics.

Of the Unix workstations we tested, our slight favorite was the HP Apollo 9000. It proved to be an excellent machine for applications development and engineering tasks, while its other scores demonstrated that it was well suited for just about any task. The HP Apollo 9000 also nearly matched the aggressive graphics performance of the

Indigo R4000, which is supposedly SGI's bread and butter.

The PowerStation 365 was the leader at floating-point operations. For engineering applications, CAD, and database work, it would be a very good choice. Although the IBM and SGI were strong performers, we found their versions of Unix (AIX and Irix) to be a bit less friendly than the highly versatile HP/UX with its clean Motif GUI.

Although the Indigo XZ was the fastest machine we tested at 3-D graphics, it was also the most expensive. It handled float-

ing-point calculations very effectively making it suitable for engineering and scientific environments. It is no wonder that SGI Indigos are so often used by Hollywood firms for animation renderings.

We were disappointed with the SPARCstation, which fell short of the competition in every respect, save one—connectivity. It was comparatively slow for its \$11,000 list price, and was easily beaten by the Deskpro 5/66M, which is not even optimized for the SCO Unix system we used during the low-level performance tests. It would be suitable as a cli-

■ Preview: *Alpha AXP PC*

by Jon Hill

The Alpha AXP PC's short tower case seems indistinguishable from Digital Equipment Corp.'s Intel-based offering, until you remove the oversized heat sink and discover a 150-MHz version of Digital's Alpha chip (the heat sink is twice as large as that in any Intel-based PC). What makes a PC a PC? Digital is trying to confound that issue with the release of its Alpha AXP PC, a RISC-based computer that will run Microsoft's Windows NT operating system.

Set to be priced between \$7,000 and \$10,000, the AXP promises to deliver 1.5 to 2 times the performance of machines based on Intel's Pentium chip (66 MHz) at the same price. Alpha AXP will house six EISA slots, standard SIMM slots for 12MB to 128MB of RAM, five drive bays, Compaq's QVision graphics controller, an Adaptec SCSI controller, and a 3.5-inch floppy disk drive.

Digital has been shipping workstations based on 150-MHz versions of the Alpha for some time now, but the units currently run only under OpenVMS—hardly a threat to Intel's dominance. Recent announcements of 200-MHz AXP workstations, and the completion of Digital's OSF/1 operating system, will improve the company's position in

the workstation market but are not likely to have much of an impact in the world of PCs.

By the time you read this, however, Digital will be betting that Windows NT running on the AXP PC will redefine what constitutes a personal computer. The installation procedure under NT will ask you to tell it which platform the operating system will be running on: Alpha, Intel, or MIPS. Another clue will be its speed: Digital claims the Alpha AXP PC will be the fastest NT machine in town.



Digital's new AXP PC.

support. Digital claims the integrated unit will deliver between 70 and 80 percent of the performance of its higher-speed cousin, with system prices starting at about \$4,000.

If current projections hold up, you may see Alpha-based laptops by the first quarter of 1994,

and 200-MHz desktop PCs by early next year. In the meantime, Digital is busy rounding up OEMs interested in putting Alpha chips into their own systems, and has begun to license third-party manufacturers of the chip itself.

While Digital seemingly has little interest in putting together a VL-bus implementation—preferring to wait for its PCI-integrated chips to ship—a third-party vendor might decide that a relatively fast VESA card in a super-fast Alpha system would make an attractive high-end product.

One thing is clear: Digital is committed to its Alpha technology. The 100-MHz to 200-MHz current and near-future models are early explorations of what Alpha's stripped-down RISC architecture can achieve. Digital's engineers claim that future Alpha implementations may achieve raw clock speeds approaching a gigahertz as early as 1996. Mind boggling, if true. But is it really a PC? □



AXP's interior shows Alpha's large heat sink.

By the third quarter of this year, Digital plans to release a low-cost version of the AXP PC, wrapped around a 100-MHz version of the Alpha chip that will feature built-in PCI local-bus

SOFTWARE

Product Media Price

Spreadsheets

- ☐ Lotus 1-2-3 Windows 1.1 F5 \$ 315
Item #58836-16
- ☐ Lotus 1-2-3 Windows 1.1 F3 \$ 315
Item #61837-16
- ☐ Lotus 1-2-3 Windows 1.1 Upgrade F3 \$ 99
Item #4832-16
- ☐ Microsoft Excel for Windows 4.0 F3 \$ 299
Item #53253-16 (5.25 available)
- ☐ Microsoft Excel for Windows 4.0 Upgrade F3 \$ 119
Item #44625 (5.25 available)
- ☐ Lotus 1-2-3 2.4 F3 \$ 335
- ☐ Lotus 1-2-3 2.4 Item #69601-16 F5 \$ 335



\$99 Lotus 1-2-3 Upgrade

Word Processing

- ☐ WordPerfect 5.2 for Windows F3 \$ 275
Item #77919-19 (5.25 available)
- ☐ WordPerfect 5.2 for Windows Upgrade F3 \$ 79
Item #57683-19 (5.25 available)
- ☐ Microsoft Word for Windows 2.0b F3 \$ 299
Item #64932-19 (5.25 available)
- ☐ Microsoft Word for Windows 2.0b Upgrade F3 \$ 119
Item #62910-02 (5.25 available)

Product Media Price

Word Processing Con't

- ☐ Lotus Ami Pro 3.0 Dual \$ 249
Item #55236-19
- ☐ Lotus Ami Pro 3.0 Upgrade Dual \$ 99
Item #32259-19

Database

- ☐ Borland Paradox 4.0 F3 \$ 499
Item #63329-08
- ☐ Borland Paradox 4.0 Upgrade F5 \$ 499
Item #63325-08
- ☐ Borland Paradox 4.0 Upgrade F3 \$ 185
Item #89829-08
- ☐ Borland Paradox 4.0 Upgrade F5 \$ 185
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- ☐ DataEase Express for Windows F3 \$ 145
Item #85902-11
- ☐ Symantec Q&A 4.0 F3 \$ 249
Item #95743-13
- ☐ Symantec Q&A 4.0 F5 \$ 249
Item #17461-13

Presentations/Graphics

- ☐ Lotus Freelance Graphics for Windows F3 \$ 339
Item #29190-10 (5.25 available)
- ☐ Lotus Freelance Graphics for Windows Upgrade F3 \$ 99
Item #00802-10 (5.25 available)
- ☐ Harvard Graphics for Windows 1.01 F3 \$ 349
Item #37744-10
- ☐ Harvard Graphics for Windows 1.01 F5 \$ 349
Item #89734-10
- ☐ Microsoft PowerPoint 3.0 F3 \$ 299
Item #12531-03
- ☐ Microsoft PowerPoint 3.0 F5 \$ 299
Item #82528-03
- ☐ Aldus Persuasion 2.1 F3 \$ 315
Item #77993-03
- ☐ Aldus Persuasion 2.1 F5 \$ 315
Item #83997-03
- ☐ Spinnaker PFS: Publisher for Windows F3 \$ 89
Item #38972-04

Product Media Price

Integrated

- ☐ Lotus SmartSuite F3 \$ 459
Item #71818-13
- ☐ Lotus SmartSuite F5 \$ 459
Item #73818-13
- ☐ Microsoft Office 3.0 F3 \$ 459
Item #36837-13
- ☐ Microsoft Office 3.0 F5 \$ 459
Item #49836-13
- ☐ Spinnaker PFS: WindowWorks 2.0 F3 \$ 75
Item #40941-13

General

- ☐ Chipsoft TurboTax for Windows Headstart Dual \$ 47
Item #73918-02
- ☐ Chipsoft TurboTax for DOS Headstart Dual \$ 47
Item #00635-02
- ☐ Intuit Quicktax 6.0 Dual \$ 39
Item #79785-02
- ☐ Intuit Quicktax for Windows 2.0 Dual \$ 29
Item #45870-02
- ☐ Intuit Quickbooks Dual \$ 89
Item #38392-02
- ☐ IBM OS/2 2.0 F5 \$ 139
Item #23449-17
- ☐ IBM OS/2 2.0 F3 \$ 139
Item #26442-17
- ☐ Symantec Norton Desktop for Windows 2.0 F3 \$ 109
Item #88164-11

Product Media Price

General Con't

- ☐ Symantec Norton Desktop for Windows 2.0 F5 \$ 109
Item #63129-11
- ☐ Quarterdeck QEMM 386 F3 \$ 59
Item #4501-0-17
- ☐ Quarterdeck QEMM 386 F5 \$ 59
Item #42019-17

PERIPHERALS AND ACCESSORIES

Multimedia

- ☐ Creative Labs Multimedia Upgrade Kit Int \$ 549
Item #30738-25
- ☐ Creative Labs Sound Blaster Pro Int \$ 189
Item #61991-54
- ☐ MediaVision Pro 16 Multimedia System Int \$ 899
Item #23507-54
- ☐ MediaVision Multimedia Upgrade Kit Plus Int \$ 735
Item #38504-54
- ☐ MediaVision Fusion 16 Multimedia Upgrade Kit Int \$ 499
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<input type="checkbox"/> Practical Peripherals 2400 SA 9600Fax Item #55492-41	Ext	\$ 109
<input type="checkbox"/> Practical Peripherals 9600 SA w/QuickLink II Item #17710-41	Ext	\$ 305
<input type="checkbox"/> Hayes Optima 96/SmartCard EZ 32/42BIS Item #60063-41	Ext	\$ 349
<input type="checkbox"/> Cardinal MB14400 V.32 w/Turbofax V.42 Item #40355-41	Ext	\$ 309



\$189 Sound Blaster Pro

Monitors

<input type="checkbox"/> NEC MultiSync 3FGX Item #55195-23	\$ 689
<input type="checkbox"/> NEC MultiSync 4FG Item #75319-23	\$ 799
<input type="checkbox"/> Radius PrecisionColor Display 19 Item #89497-23	\$ 2,229
<input type="checkbox"/> Dell UltraScan 14C Item #320-3364	\$ 449
<input type="checkbox"/> Dell UltraScan 15FS Item #320-3369	\$ 549

Printers

<input type="checkbox"/> IBM/Lexmark Personal Printer II 9Pin 80CL Item #99025-27	\$ 349
<input type="checkbox"/> IBM/Lexmark Personal Printer II 24Pin 80CL Item #87025-27	\$ 349
<input type="checkbox"/> Epson AP-3250 Item #330-1482	\$ 205
<input type="checkbox"/> Canon BJ-110 Ink Jet Item #72069-28	\$ 329
<input type="checkbox"/> IBM/Lexmark Color Jetprinter 4079 LJ Item #12993-28	\$ 2,749
<input type="checkbox"/> IBM/Lexmark 4070 LJ Item #79832-28	\$ 375
<input type="checkbox"/> Epson EPL-8000 Item #330-3347	\$ 1,159

Printers Can't

<input type="checkbox"/> IBM/Lexmark 4019 Laser Printer Item #79641-37	\$ 849
<input type="checkbox"/> Genicom Model 7170 Item #12844-37	\$ 3,215
<input type="checkbox"/> Okidata O1400P LEO Page Printer Item #70695-37	\$ 649
<input type="checkbox"/> Texas Instruments Microlessor Basic Item #13399-37	\$ 899
<input type="checkbox"/> Texas Instruments Microlessor PS17 Item #12814-37	\$ 1,215

Storage

<input type="checkbox"/> Quantum Prodrive ELS 85MB IDE Item #03731-34	Int	\$ 215
<input type="checkbox"/> Quantum Prodrive ELS 127MB IDE Item #09734-34	Int	\$ 289
<input type="checkbox"/> Quantum Prodrive ELS 170MB IDE Item #16736-34	Int	\$ 325
<input type="checkbox"/> Conner SoftStar 3170 Item #76828-34	Int	\$ 565
<input type="checkbox"/> Colorado Jumbo 250 0J-20 Item #88977-26	Int	\$ 269

Product	Media	Price
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Storage Can't

<input type="checkbox"/> Iomega Tape 250 Insider Halfheight Item #35848-34	Int	\$ 249
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Networking

<input type="checkbox"/> Artisoft LanTastic Windows Utility 4.1 Item #20664-36	Dual	\$ 179
<input type="checkbox"/> Artisoft LanTastic Starter Kit 4.1 Item #89634-36	Dual	\$ 489
<input type="checkbox"/> Novell Netware Lite 1.1 Item #02829-36	F5	\$ 59
<input type="checkbox"/> Novell Netware Lite 1.1 Item #01827-36	F3	\$ 59
<input type="checkbox"/> Windows for Workgroups Item #13151-17	F5	\$ 159
<input type="checkbox"/> Windows for Workgroups Item #13166-17	F3	\$ 159
<input type="checkbox"/> SMC Ethercard +Elite 16 Combo Item #23477-36	Int	\$ 198
<input type="checkbox"/> SMC Ethercard +Elite 16T Int Item #11544-36	Int	\$ 145
<input type="checkbox"/> IBM Token Ring 16/4 Item #89733-36	Int	\$ 549



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Benchmark Tests: Workstation Platforms

While midrange workstations from HP, IBM, and Silicon Graphics stood out on our tests, the Pentium-based Compaq is a viable contender.

Our PC/Mac Applications test results show that the Pentium-based Compaq Deskpro 5/66M has lapped its Macintosh competition, even in domains once thought of as belonging solely to the Mac. The Compaq unit rendered our 24-bit Typestry sample eight times as fast as the Apple Macintosh Quadra 800. The ATI Graphics Ultra Plus board we installed in the Compaq for this test was an ISA card (we replaced the EISA Compaq QVision card in order to render a 24-bit image at 800-by-600 resolution); although capable, it is by no means the fastest 24-bit PC graphics card available. Most of the performance gains for this type of processing come from the Pentium's improved FPU (floating-point unit) and enhanced processor cache.

While the Pentium chip's performance puts the PC on the same playing field as the other workstations in this roundup, PC performance still lags behind the performance of midrange workstations in many areas. Although SPECfp92 floating-point performance was much improved (the Compaq performed three times as fast as a 486-DX2/66 tested previously under similar conditions), it was less than half that of either the HP or the IBM unit we tested, and roughly half that of the Silicon Graphics unit. The compilers used during our testing have not been optimized for the Pentium, but neither have the applications that users are likely to run.

The Compaq's disk-intensive test scores—a factor in the Khronerstone test results—also suffered from SCO Unix's poor use of disk buffers. Moreover, as the Graphstone scores show, the Compaq QVision graphics board paled in comparison with the HP Apollo 9000's X11 graphics accelerator and was completely overshadowed by the performance of the Indigo XZ's GL graphics processor. The Sun SPARCstation LX performed well only on the Stanford Recursion test suite.

The midrange workstations from Hewlett-Packard, IBM, and Silicon Graphics clearly outperformed the other units in this roundup. The HP Apollo 9000 was arguably the best-rounded performer. While the IBM RS/6000 PowerStation 365 performed well in every category except graphics, it excelled at floating-point operations and multiprocessing capacity. And we found the Indigo XZ, justly famous for its 3-D graphics engines, to be equally adept at floating-point operations.

How We Tested

WSL, an independent testing facility well known in the Unix world, conducted much of the testing for this roundup. The full suite of tests is available on ZiffNet (11PLAT.ZIP) in Library 2 (Features Hardware) of the Editorial Forum. The Compaq 5/66M ran SCO Open Desktop, Release 2.0, for the Unix-based tests; other system configurations (and the compiler switches used for the SPECmark tests) are specified in our fact files. WSL did not test the Apple Macintosh Quadra 800; much of the Mac's performance is tied to System 7.1, and Unix-based scores would be misleading at best.

Dhrystone, Version 2.0, is a series of CPU-intensive tests written in C. They are most useful for measuring the performance of systems' programming applications. We report a composite score for each product.

Graphstone is a series of 125 routines, testing 13 different graphics types (such as lines, filled and unfilled polygons, circles, and arcs). The tests are weighted, and we report a composite score for each product. All products were tested using X11 library calls; the Indigo XZ was also tested under its native GL graphics library.

Khronerstone results are calculated from 21 tests that stress each workstation's CPU, FPU, and disk subsystem.

SPECmark SPEC89 is a suite of ten CPU- and FPU-intensive tests supplied by Systems Performance Evaluation Cooperative (SPEC). SPECmarks are a measure of relative performance, where the VAX11/780 is defined as a 1-SPECmark machine. **SPECmark SPECfp92** and **SPECmark SPECint92** are newer versions of the SPEC tests that return separate results for floating-point and

integer operations, respectively.

The single-precision and double-precision **Whetstone** tests are designed to simulate the FPU-intensive programs used in engineering and scientific computing.

X11PERF is a graphics test based on the classic public-domain test of an X11 server.

At PC Labs, we ran ten Unix-based "Stanford" test routines, which characterize multiprocessing capability. Each routine is run as a single process and then as 2, 4, 8, and 16 concurrent processes. We classified the tests into three groups (floating-point, integer, and recursive operations); each point plotted on our graphs represents a product's average timing within the group of tests.

Fast Fourier Transformation and Floating-Point Matrix Multiply, part of our **Stanford Floating-Point** test suite, are two standard gauges of floating-point performance. These routines are similar to code used in three-dimensional transformations, two-dimensional image enhancement, and scanning routines. **Mandel** is the FPU-intensive Mandelbrot algorithm, a form of matrix multiplication using complex numbers.

Our **Stanford Integer** test suite is made up of **Bubble**, which implements the standard bubble-sort algorithm using two nested loops; **Integer Matrix Multiply**, which performs a matrix multiply on integer arrays; and **Puzzle**, a compute-bound algorithm that employs many nested loops.

The **Queens**, **Quick**, **Towers**, and **Tree** algorithms, which form our **Stanford Recursion** test suite, perform numeric compares on simple data structures with almost no math involved.

The **AutoCAD** tests, developed by the AutoCAD Users Group of San Diego, measure elapsed times for 18 CAD operations. We normalize each individual test result against the slowest performer on the test in question; we then weight these preliminary results and compute a harmonic mean. AutoCAD is not available for the Silicon Graphics unit. Version 11 is the most recent release available for the Apple Macintosh Quadra 800; we used AutoCAD, Release 12, for the remaining systems.

To compare the Deskpro 5/66M, running Windows 3.1, with the Quadra 800, PC Labs developed a **PC/Mac Applications** test suite, consisting of multiple routines for word processing (Microsoft Word, WordPerfect), spreadsheets (Lotus 1-2-3, Microsoft Excel), desktop publishing (Aldus PageMaker), and graphics rendering (Pixar Typestry). We normalize each individual test result against the slowest performer on the test in question; we then weight these preliminary results and compute a harmonic mean for each category.

WORKSTATION LABS TESTS

Dhrystone

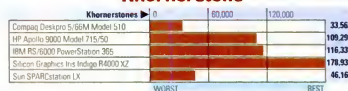


Graphstone

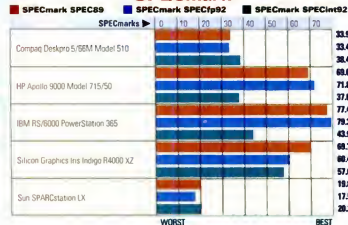


* Using the GL library The X11 library score was 57.698

Khornerstone



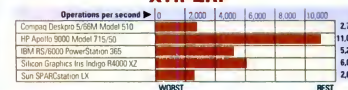
SPECmark



Whetstone

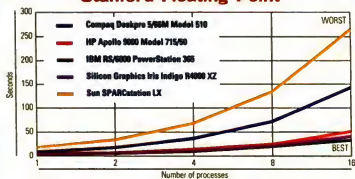


X11PERF

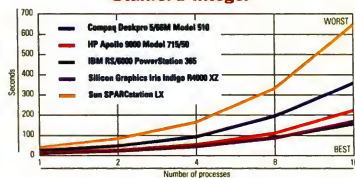


PC MAGAZINE LABS TESTS

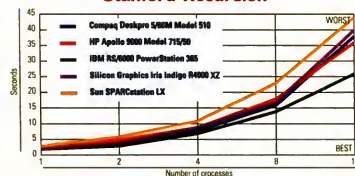
Stanford Floating-Point



Stanford Integer



Stanford Recursion

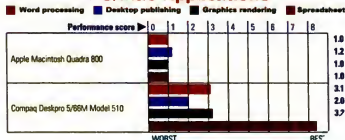


AutoCAD



N/A—Not applicable. AutoCAD does not run on this unit

PC/Mac Applications



ent in an NFS-based Sun Ethernet server network. Otherwise, the LX was too underpowered and quirky to be of good utility for the tasks we rated. Note, however, that Sun's line includes several other high-performance machines.

The Quadra 800 also disappointed us, because we expected its raw performance to be better. Although the Finder is the best GUI of any we tested, and System 7.1 is a distinct cut above DOS 6.0/Windows 3.1, the Quadra 800 ought to be faster overall. As Windows 3.1 matures into Windows NT and Microsoft starts to improve the GUI further, the Apple Finder advantage won't be as significant. Of course, the primary reason Apple is moving its entire Macintosh line onto the PowerPC RISC CPU is that the company has nearly exhausted the performance potential of the Motorola 680X0 processor.

Still, given that companies like Radius (Rocket board) and DayStar (PowerCache), sell faster 68040 CPU add-on coprocessor boards, you have to wonder why Apple can't squeeze more performance out of the Quadra 800. Perhaps the Macintosh Cyclones, which should be available this summer with their hot digital-signal coprocessors, will finally extract all the performance that a 68040 can offer in a Mac.

HOW SHOULD YOU CHOOSE?

Whew! How do you sort through all those test results and task ratings and make a choice? The first thing you must decide is whether or not you are willing to leave the comfortable environs of the DOS and Windows worlds. If not, then don't even consider a Macintosh or Unix box. Performance aside, the quality of your interaction with your computer is the most important issue, and only you can decide which system works best for you.

The basic truth, after all this testing, is that most PC users won't buy Unix systems for the simple reason that none of them is as good as a PC at providing sta-

ble, reliable, cost-efficient productivity applications. That fact hasn't changed over the last year, although all the Unix systems we tested are doing a much better job of attracting productivity software vendors to their platforms and their versions of Unix.

If the trend continues, by 1994 you may very well see the major Unix workstation vendors offering most of the productivity programs you take for granted on your PC. Of course, they will still be providing them on an underlying Unix operating system, which will put off (or frighten) many PC folk. More difficult will be choosing among the Windows NT solutions that run on Intel and RISC processors.

A big choice for many PC people won't be between buying a faster PC (like our Pentium-based Deskpro 5/66M) and a Windows NT/RISC platform or Unix workstation, but between buying a faster PC and a high-end Macintosh (including the PowerPC). As you can see from our performance test and task scoring, the Quadra 800 still asks you to pay a considerable price for its excellent System 7.1 and Finder GUI.

Still, any PC owners who are contemplating bigger, faster machines than the old war-horses currently on their desks should check in with their neighborhood Apple dealers to find out what the hullabaloo is all about. There are some PC users who will want to take a very serious look at Unix workstations, Macintoshes, and even Pentium-based PCs running Unix. Why? Unix offers considerable connectivity prowess and access to some scientific, rendering, engineering, and CAD software that will never live properly on DOS or even Windows NT. And the Quadra 800 offers an alternative and brilliantly smooth GUI, and a growth path to workstation operating systems with its upcoming PowerPCs.

If you plan to run specific categories of software (scientific, 3-D modeling, and so on), and you need the best performance available, then look closely at the

top three Unix workstations we tested—the HP Apollo 9000, the PowerStation 365, and the Indigo XZ. If you think that you must have a standalone SPARCstation, you will probably want to consider a more expensive and higher-powered model than the SPARCstation LX we tested (which just couldn't match its higher-priced competitors).

A SUMMATION

The Pentium chip (used in our test Compaq machine) really is a speed and performance breakthrough for PCs. It has enough horsepower to blow away a similarly configured Macintosh, and to play in the same league as midlevel Unix workstations when running SCO Unix (it will be interesting to test Sun's Intel Solaris and NeXT's 486 NeXTStep on a Pentium-based PC to see if this holds up for other Unix variants).

However, while our test Deskpro 5/66M beat up the Quadra 800 at rendering, its low-level performance tests against the Unix competition show that it still lags behind the midrange workstations in many performance areas. While the Pentium-based PC is at least on the same playing field, you shouldn't buy one thinking that it will provide you with the same kind of performance that a workstation like the HP Apollo 9000, PowerStation 365, or Indigo XZ can crank out.

While the SPECfp92 performance of the Deskpro 5/66M was three times better than the 486DX2/66 we tested last year, it was still less than half as fast as the HP Apollo 9000 and PowerStation 365 and about half as fast as the Indigo XZ. Unix workstations still have serious performance advantages for both integer- and floating-point-based applications, as well as graphics rendering.

That is really our bottom line. If you plan to stick with the productivity/application mix that you currently have, then upgrading to a Pentium-based PC, on which you will eventually run Windows NT, probably makes the most sense. However, if you need high performance for engineering, 3-D graphics, and networked applications development (especially networked databases that use SQL), then Unix workstations deserve a long look.

PC Tools Version 8.0

Just when the competition thought it was safe to come out, Central Point releases PC Tools Version 8.0... [an] extensive collection of first-rate utilities in a single package, all for the impressive price of \$179.95"

- InfoWorld, Nov. 16, 1992

"So many well-designed utilities at such an economical price add up to a triumph of programming and design."

- PC Magazine, Dec. 22, 1992

PC Tools leapfrogs competitors such as Symantec's Norton Desktop for DOS and Norton Utilities... Strong DOS utilities will please power users, while its new drag-and-drop desktop can make DOS a friendlier environment for novices."

- PC Week, Oct. 5, 1992

"If Norton Utilities' interface is simple, PC Tools' interface is beautiful. Without a doubt, PC Tools gives you more for your money and is the better all-around program."

- PC/Computing, Feb. 1993

PC Computing

InfoWorld

PC/Computing

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Compaq Computer Corp.

Compaq Deskpro 5/66M Model 510

BY DON CRABB

Nearly a year ago, we were raving about 50-MHz 486DX systems. Then just a few months later we rolled out the bandwagon for 50-MHz 486DX2s. And then early this year, we ballyhooed 66-MHz 486DX2s. Are we fickle, or has the performance treadmill for PCs become so fast that new machines seem to spin wildly off it into space?

Well, we suspect a little of both. The simple truth is that every new Intel x86 processor upgrade has created an entirely new and faster generation of DOS-based PCs. Now with the 586—oops! we mean the Pentium—Intel has raised the performance bar even higher.

For testing, we chose to use a hot new Compaq Deskpro 5/66M powered by Intel's Pentium CPU. It was equipped with an ATI Graphics Ultra Plus board for tests involving 24-bit images and a QVision 1024/E card for other testing. We tested the Deskpro 5/66M with DOS 5.0, Microsoft Windows 3.1, and Version 4.0 of SCO Unix 3.2 so that we could compare its raw performance to Unix workstations running Workstations Labs' (WSL) low-level benchmark tests.

The Deskpro 5/66M was chosen as a representative PC platform because its Pentium processor enables it to compete with midrange workstations on a number of tasks and because Compaq systems have become good values over the last year. Although our test platform was not formally priced at press time, Compaq reported it would list for about \$7,500 to \$8,000.

Besides the 66-MHz Intel Pentium CPU, our configuration included 32MB of RAM, a 20-inch color monitor, a QVision 1024/E card, a 510MB hard disk

drive, DOS 5.0, and Microsoft Windows 3.1. For SCO Unix 3.2, Version 4.0, you must pay an additional \$1,495. The FORTRAN compilers that WSL used during testing are \$995. All tests were run fully optimized for an Intel 486, which was the best that WSL could do with the current version of SCO Unix (which is not yet Pentium-specific).

PC PREDOMINATES

Among the different workstations tested, the Pentium-packed Deskpro 5/66M provided the most solid price/performance ratio. With the addition of the SCO Unix operating system, the Deskpro 5/66M beat the Sun SPARCstation LX and acquitted itself well on most of the other low-level tests. None of the tested workstations beat it at performing general business applications, and none showed more overall value.

The Deskpro 5/66M ran the Rayshade graphics test two to three times as fast as the SPARCstation LX, had equivalent Khronstone scores (because of its slower hard disk), and ran most of the floating-point tests faster. That's excellent performance for a PC that is not optimized to run Unix (as the workstations are). The only category in which the Deskpro 5/66M's performance was mediocre was in two-dimensional and three-dimensional graphics processing.

Today's fastest PCs (including the Deskpro 5/66M) run as much as 50 times as fast as an original IBM PC or XT, and 20 times as fast as a 286-based AT-class PC. Compared with a slower PC that WSL tested (a Mobius 486DX running at 50 MHz), the Deskpro 5/66M ran the low-level tests from half as fast to four times as fast.

The Deskpro 5/66M's excellent hard disk performance was much better than



The Compaq Deskpro 5/66M is powered by Intel's brand-new 66-MHz Pentium chip, which makes the PC a challenger to RISC-based workstations.

the Mobius's, which is surprising considering that the Mobius has a fast SCSI bus (the Deskpro 5/66M uses a theoretically slower IDE drive). The Deskpro 5/66M also was as much as three times as fast as the Mobius at floating-point unit-intensive applications.

Based on WSL's tests and our own use, it's pretty clear that the Deskpro 5/66M's disk I/O problems stemmed from SCO Unix's ineffective use of disk buffers. This would not be a problem when running the machine under DOS or Windows NT, though, and if necessary you can always specify a faster hard disk, or you can opt for an optional SCSI interface.

PC SOFTWARE ADVANTAGE

The Deskpro 5/66M's software advantage comes from the impressive quantity and quality of programs on the market. You should not buy a midrange Unix workstation simply for running word processing or spreadsheet packages. PCs will continue to have access to a broad and deep supply of software, including multiple productivity applications. High-quality graphics software used to appear for Apple machines 18 to 24 months before it appeared for PCs. Because of the success of Windows, you now see nearly simultaneous Macintosh and Windows software releases. With the advent of Windows NT and better PC graphics cards, PCs will conceivably see graphics releases before Macs do (the PowerPC will confuse this issue, however).

When it comes to custom or turnkey

SUITABILITY TO TASK				
Compaq Deskpro 5/66M Model 510				
	POOR	FAIR	GOOD	EXCELLENT
Applications development	●	●	●	●
Connectivity	●	●	●	○
Engineering/scientific/ 2-D CAD	●	●	●	○
Desktop publishing	●	●	●	○
3-D graphics	●	●	○	○
Office productivity	●	●	●	●

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**Compaq Deskpro 5/66M
Model 510**

Compaq Computer Corp., P.O. Box 692000,
Houston, TX 77269-2000; 800-345-1518,
713-370-0670

Estimated price (tested configuration): From
\$7,500 to \$8,000.

Motherboard and CPU: Compaq Pentium board, 66
MHz; 32MB RAM; 256K direct-mapped external pro-
cessor cache.


Storage: 510MB Conner IDE hard disk, 3.5-inch
1.44MB floppy disk drive.

Display: 1,280-by-1,024; 2MB VRAM; 20-inch monitor.

Graphics adapter: QVision 1024/E; ATI Graphics Ultra
Plus (\$499).

Software: DOS 5.0; Microsoft Windows 3.1; SCO Open
Desktop Development System, Version 2.0.0 (\$1,795);
SCO Open Desktop Personal System (\$1,495);
Microway NDP Fortran-486 4.1c (\$395); switches used:
-n2 OLM C Compiler (included with Open Desktop);
-w2 switches used -O; Graphics library: X11.

In short: The Pentium CPU pushes the PC into a perfor-
mance domain formerly associated with Unix work-
stations. While Pentium-based systems still can't beat
midrange Unix workstations at engineering and graphics
applications, Pentium promises to force workstation
manufacturers to boost their PC performance.

 ON READER SERVICE CARD

PCs, however, as it is on the other plat-
forms tested. This is changing with the
advent of PC shrink-wrapped LANs (that
is, file servers with preinstalled network
operating systems, network cards for the
server and PCs, and cabling). Moreover,
by buying everything from one source,
you get single-vendor accountability.

Apple Computer, Sun Microsystems,
Hewlett-Packard Co., IBM Corp., and
Silicon Graphics already build various
levels of network support into their re-
spective operating systems. Now Micro-
soft has done the same with Windows for
Workgroups, which will eventually be-
come part of Windows NT. This will put
PC networking operating systems on a
reasonably level playing field with the
likes of System 7.x and Unix.

SUITABILITY SUITE

As with the other machines here, we
rated the Deskpro 5/66M for its suitabil-
ity to six different tasks: applications de-
velopment; connectivity; engineering,
scientific, and 2-D CAD; desktop pub-
lishing; 3-D graphics; and office produc-
tivity. The Deskpro 5/66M excelled at
office productivity and applications de-
velopment (thanks again to the surfeit of
excellent development systems for DOS
and Windows). It garnered a 3 rating for
connectivity; while there are ample and
highly functional network solutions, net-
working is not an integrated capa-
bility.

CONCLUSIONS

The bottom line is that Pentium
processors push the PC plat-
forms into performance do-
mains formerly associated with
Unix workstations. While they
still cannot beat midrange Unix
workstations at engineering
and graphics applications, Pen-
tium-based PCs promise to
make workstation manufactur-
ers boost their RISC process-
ors' performance in order to
maintain the price/perfor-
mance ratios for the tasks at
which their workstations excel.
Because of its fast CPU, a Pen-
tium-equipped Deskpro 5/66M
can do a good job running
engineering or desktop publish-
ing applications available either under DOS

5.0, Windows 3.1, or SCO Unix.

A Compaq (indeed, any Pentium-
based PC) would be a formidable chal-
lenger to most low-end and midrange
Unix workstations (in the \$11,000 range)
if you tossed in a SCSI-2 hard disk drive
and a better version of PC Unix. It could
take on the higher-priced machines (like
the HP, IBM, and Silicon Graphics offer-
ings tested here) with a faster, high-
resolution graphics card, sure to hit the
PC market later this year.

Apple Computer

Apple Macintosh Quadra 800

BY BERNARD J. DAVID

The Apple Macintosh has traditionally
defined ease of use in desktop comput-
ing. With its operating system design,
mouse-driven graphical user interface,
and ability to connect to peripherals and
other computers in a simple plug-and-
play manner, the Mac reflects Apple's
mission to keep the user—rather than the
programmer—in mind as its primary
stakeholder.

Today, all Macs ship ready to use out
of the box with System 7.1, an Apple
SuperDrive floppy disk drive (which
reads Mac, DOS, Microsoft Windows,
OS/2, and ProDOS disks), and built-in
networking, sound, and video capabili-



Apple's high-end Quadra 800 excels at graphical applications and desktop publishing. The System 7.1 operating system and user interface make the Quadra easy to use and configure.

applications, the PC is far ahead of the
other test machines (the Mac comes in
second). Clever vertical-market pro-
grams such as cattle-management soft-
ware or specialized databases are much
more likely to appear in DOS versions
than in software for Macs or Unix work-
stations.

CONNECTIVITY

When it came to connecting the Deskpro
5/66M to other machines, we found that
the simplest connection was to another
PC, although Unix workstations and
Macs offer some excellent connectivity
options. The PC offers users many net-
working choices, ranging from peer-to-
peer networks to server-based networks
running Novell's NetWare, Banyan's
VINES, or Microsoft's LAN Manager—
on Ethernet or Token-Ring. This range
of choices is easily as broad the range
available for any other platform. Net-
working is not an integrated capability of

ties. Apple machines are based on Motor-
ola 680x0 processors, although the future
Mac operating system will probably use
the PowerPC chip being developed by
Apple, IBM Corp., and Motorola.

Mission



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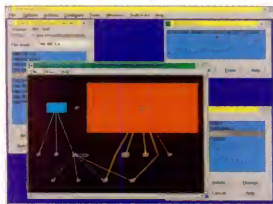
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C Set ++

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	ISO 9899:1990
Optimization	Global
	Inter-module
	Function inlining
	Instruction scheduling

starts here.



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The Apple line includes desktop, compact, and portable machines, and the company just introduced its first dedicated servers. The recently redefined desktop series includes the low-cost Macintosh LCIII (68030, 16 MHz) and Macintosh IIfx (68030, 32 MHz), the Centris 610 (68040, 20MHz), and the Centris 650 (68040, 25 MHz) round out the moderately priced desktop Macs. The Quadra 950 (68040, 33 MHz) is Apple's only tower computer and the most powerful of the line. Transportables include the Macintosh Classic II (68030, 16 MHz) and the first color transportable, the Macintosh Color Classic (68030, 16 MHz).

We tested the Apple Macintosh Quadra 800, the most powerful of the desktop Macs, which features a 33-MHz Motorola 68040 chip and 32-bit data bus. The Quadra 800 can accept up to 136MB of RAM (using 8MB single in-line memory modules), while the Quadra 950 can only expand to 64MB. Priced at \$8,690, our test machine included a 33-MHz 68040, 24MB of RAM, a 500MB hard disk drive, a 16-inch color monitor, built-in Ethernet, and a SCSI interface.

We pitted the Quadra 800 against the Compaq Deskpro 5/66M model 510, each running its most popular operating system (System 7.1 and DOS 5.0/Windows 3.1, respectively), in a series of application tests, which involved word processing, spreadsheets, desktop publishing, and image rendering. As our tables show, the Quadra 800's processing power paled in comparison with the Pentium-powered Deskpro 5/66M's. Its performance was strongest in desktop publishing. Its suitability-to-task scores were high for connectivity, three-dimensional graphics, and office productivity.

The computer industry is a game of leapfrogging technologies. While DOS-based PCs have gained a power advantage with the new Pentium chip (which compares with the Mac's aging Motorola

680x0 line). Apple's system software remains superior (in terms of elegance of design, functionality, and ease of use) to DOS/Windows software. Apple aims to match Pentium's power with systems that are based on the Apple/IBM/Motorola PowerPC chips. Windows NT is Microsoft's attempt to surpass Apple's System 7.1 (NT is multitasking, multithreaded).

The test results reflect the Mac's strength among its installed base. The Mac's strongest sales traditionally have been in the desktop publishing, education, graphics, and home markets. Graphical software has particularly distinguished the Mac and made it popular among its users.

The amount of third-party software packages available for the Apple and PC platforms is about equal. Thousands of applications are available for the Mac, including programs from Microsoft, the largest producer of Mac software.

Apple takes great pains to ensure that its computer designs make sense to people who use them. This is one reason why its PowerBook, which has won several recent design awards, is selling so well. Apple insists that applications adhere to its Human Interface Guidelines, a set of rigid standards for applications' look and feel. This gives users a consistent, easy-to-learn operating environment. Apple's ease of use extends to the addition of expansion cards, printers, and other peripherals, which are truly plug-and-play. The system software recognizes and automatically configures the attached device.

System 7.1 contains code for generalized functions that applications can use, which enables Mac programs to be smaller than their DOS, Windows, and OS/2 counterparts. Microsoft Word for Windows, fully loaded, requires 15MB of hard disk space and 4MB of RAM on Windows, while Word for Mac occupies only 6.7MB of disk space. Application programs can use the object oriented-type extensions to perform tasks such as printing and communicating.

The Mac sports two operating systems: System 7.1, which is the native Mac operating system, and A/UX, Version 3.0, which is a version of Unix. Very few Apple users, however, run A/UX on their Macs. System 7.1 provides built-in extensions (such as QuickDraw) that let users and developers take advantage of functionality that is a part of every Mac. Apple continues to extend this functionality, most recently with its QuickTime multimedia software that lets users work with video, sound, and animation.

System 7.1 also lets applications take advantage of Publish and Subscribe, a feature that links information between documents and applications, as well as across networks, to perform automatic information updates. This is similar to Windows' OLE (Object Linking and Embedding) and DDE (Dynamic Data Exchange) capabilities.

Mac graphics capabilities let up to 16 million colors be displayed using the 32-

SUITABILITY TO TASK				
Apple Macintosh Quadra 800				
	POOR	FAIR	GOOD	EXCELLENT
Applications development				
Connectivity				
Engineering/scientific/2-D CAD				
Desktop publishing				
3-D graphics				
Office productivity				

FACT FILE

Apple Macintosh Quadra 800

Apple Computer, 20525 Mariani Ave.,
Cupertino, CA 95014;
800-776-2333, 408-996-1010

List price (tested configuration): \$8,690

Motherboard and CPU: Motorola 68040, 33 MHz; 24MB RAM; 8K internal cache (4K data, 4K instruction)

Storage: 500MB hard disk, CD-ROM drive, 1.2MB floppy disk drive

Keyboard: Ergonomic keyboard, mouse, and extended keyboard

Display: 832-by-624, 1MB VRAM, 16-inch color monitor

Graphics controller: MEMC integrated graphics controller

Network adapter: Ethernet, Apple LocalTalk

Software: System 7.1

In short: Of the various systems we tested, the user interface of the Apple Macintosh Quadra 800 is certainly the best of the bunch. The Mac traditionally has defined ease of use in desktop computing, but the Mac is out of its league when it comes to performance. The results of our application tests show that the Pentium-based PC has lapped its Mac competition—even in domains that were thought to belong solely to the Mac. On some Mac-vs.-PC graphics tests, the PC was an order of magnitude faster.



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A black and white close-up portrait of a woman with dark, wavy hair and bangs. She is wearing a dark suit jacket over a white collared shirt and a dark patterned tie. She is resting her chin on her right hand and looking directly at the camera with a slight smile.

KELLY FALLON
RESEARCH ANALYST
FIRST USED IMPROV 2/3/93

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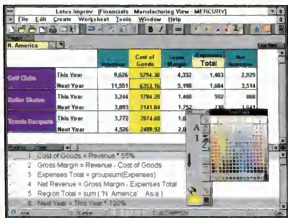
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■ Comparing CPU Architectures

The PC paradigm will shift as vendors pack new processors into PC boxes

by Nick Stam and Daniel Tabak

A large number of new and very fast processors will start appearing in personal computing systems in the next few years. CISC (complex instruction-set computing) processors from Intel and Motorola have dominated PC designs to date, and RISC (reduced instruction-set computing) processors have been prevalent in workstation-class systems.

The distinction between personal computers and workstations will become less apparent as RISC-based systems start supporting the existing base of popular Microsoft Windows and DOS applications (and future Windows NT applications) by using Windows NT. In fact, Intel's new CISC-based Pentium processor may be challenged by architecturally superior RISC chips that run NT. A number of RISC makers, including Digital Equipment Corp. and MIPS, are currently working with Microsoft to port the NT system to their designs.

RISC VS. CISC

The subject of debate since the mid-seventies has been which architecture is better, RISC or CISC. RISC processors provide a streamlined handling of instructions and include a simple instruction set. CISC processors use a more complex set of instructions.

RISC chips usually contain fewer than 128 instructions, compared with 200 to 300 in typical CISC chips. RISC chips provide far fewer instruction formats and addressing modes than CISC chips, resulting in simpler on-chip control hardware.

CISC instruction-set complexity yields slower internal operation and takes up added chip real estate for instruction decoding and control logic that could be used for other performance-optimizing features, such as larger cache sizes or more registers. The fixed length of RISC instructions (gen-

erally 32-bit) yields better alignment of instructions in memory, resulting in more efficient fetch operations.

RISC instruction-set design allows RISC chips to implement multistage on-chip pipelines more efficiently than CISC processors. RISC processors provide an additional advantage over typical CISC chips by including many on-board registers to perform calculations. RISC processors use simpler instructions than CISC chips use, but RISC-based programs often require more instructions to accomplish a task.

CISC WARS: INTEL VS. MOTOROLA

The most widely used CISC microprocessor families are Intel 80x86 and Motorola 680x0. Intel and compatible microprocessors (AMD, Cyrix, IBM, and TI) serve the PC marketplace, while Motorola chips are used in Apple Macintoshes. The most popular high-end PC and Mac CPUs are the Intel 80486 and the Motorola 68040. Each is a 32-bit microprocessor with a floating-point unit, memory-management unit, and 8K cache all included on-chip.

While the 80486 internal cache is unified (instruction and data caches combined), the 68040 features a dual cache (4K instruction/4K data) and dual memory-management units. This gives the 68040 a definite performance advantage in its pipeline operations because accesses to instructions and data can occur simultaneously. The 80486 and 68040 both have 4-way set-associative caches with 16 bytes per cache line. However, Intel enjoys a current advantage: Its 486DX2 clock-doubled chip can run at 66 MHz, while the fastest 68040 runs at 33 MHz (as seen in the new Apple Macintosh Quadra 800). Although the 68040 has architectural advantages, at the moment its performance is eclipsed by the 80486's higher clock rates.

The Pentium brings significant architectural changes to Intel's standard CISC designs. Although still a 32-bit internal design (32-bit registers, 32-bit integer operations, and a 32-bit address bus), the Pentium includes many advanced features seen in RISC processors. Its dual internal cache (8K instruction/8K data), 64-bit data bus, 66-MHz operation, improved floating-point unit, and superscalar design distance it even further from the 68040.

NEW RISC CHIPS

Alpha. In 1992, Digital Equipment Corp. unveiled its long-awaited Alpha chip. Digital is banking a good part of its future on Alpha's success and is planning for a 25-year architectural life span. Alpha supports OSF/1, VMS, and Windows NT. The fastest Alpha chip has an incredible 200-MHz clock rate and uses 1.68 million transistors. Digital achieves such high clock rates in part by using Digital's 0.75-micron CMOS-4 technology and 3.3-volt operation.

Alpha is a true 64-bit dual-issue superscalar and superpipelined design with seven integer pipeline stages, and it uses both an 8K instruction and 8K data cache. (Superpipelined chips usually have more pipeline stages than typical processors, allowing more instructions to be in various stages of execution; functional units on-chip, such as the Arithmetic Logic Unit (ALU), are often split into more than one pipeline stage.) Alpha's dual-issue capabilities are a bit restrictive, lacking the Pentium's ability to issue two integer operations in parallel. Alpha can dual-issue a floating-point and integer instruction, and a few other popular combinations of instructions.

MicroSPARC and SuperSPARC. Sun Microsystems and Texas Instruments have combined forces to manufacture

both the SuperSPARC and MicroSPARC RISC processors. The MicroSPARC, used in Sun's SPARCstation Classic and SPARCstation LX, is a 32-bit scalar (single-pipeline) processor designed for lower-cost workstations. The 800K-transistor chip integrates a dual cache (4K instruction/2K data), DRAM control, and bus interface logic. The MicroSPARC is implemented with a 0.8-micron CMOS process, runs on 5 volts, and consumes approximately 3.5 watts at 50-MHz operation. With its high integration and a static core (the CPU can be slowed down), the MicroSPARC may also be destined for use in laptop computers.

SuperSPARC is the first superscalar version of SPARC processor technology and specifically implements a three-issue superscalar design that operates at 40 MHz and is based on a 0.8-micron BiCMOS process. Still only a 32-bit processor, but with approximately 3 million transistors, the SuperSPARC has advanced superscalar features that can not only issue three instructions at once, but can handle data dependencies between instructions in its execution unit. Most superscalar processors would determine that dependencies exist, and resort to single issuance of the dependent instructions. Used in Sun's SPARCstation 10, the SuperSPARC has dual on-chip caches (20K instruction/16K data), and eight pipeline stages.

Hewlett-Packard Precision Architecture (PA/RISC) 7100. Hewlett-Packard's PA/RISC architecture has received much acclaim in the past year, particularly for its exceptional floating-point performance. The newest incarnation, called the 7100, is a 32-bit processor that runs at approximately 100 MHz and is implemented with a 0.8-micron CMOS process. Containing 850,000 transistors, the 7100 incorporates a floating-point unit on-chip, rather than the separate floating-point chips used in previous PA/RISC architectures.

Classically, PA/RISC designs have not incorporated cache on-chip, and the 7100 is no different. HP relies on fast

SRAM caches just outside the chip, accessed with a 64-bit data path. This allows system vendors to build larger or smaller processor caches depending on target markets; data cache can range from 4K to 2MB and the instruction cache ranges from 4K to 1MB. Similar to the Alpha, the 7100 is a dual-issue superscalar design with the restriction of not being able to issue two operational integer instructions at a time. HP currently includes 33-MHz, 50-MHz, and 99-MHz versions of the 7100 in many recently announced HP Apollo 9000 Model 715/50 workstations.

MIPS R4000 and R4400. Silicon Graphics acquired financially troubled MIPS Computer Systems in June of 1992 to ensure that MIPS chip technology would not flounder (all SGI workstations use MIPS RISC chips). The MIPS R4000 was the first true 64-bit microprocessor with 1.3 million transistors using a 1-micron CMOS design. The R4000 includes a dual cache (8K instruction/8K data), an on-board floating point, and a second-level cache control logic in higher-end versions.

The R4400 is basically a new, souped-up R4000 with larger internal caches (16K instruction/16K data) and faster clock rates. Using a 0.6-micron CMOS process, the R4400 contains 2.2 million transistors. Both chips are considered dual-issue superpipelined, with the ability to issue two instructions down their pipelines during each external clock cycle. Internally, the R4000 runs at 100 MHz—double its external 50-MHz clock input—so all pipeline operations are performed in half-clock timings with respect to the external clock. The R4400 uses a 75-MHz external clock and runs its pipeline at 150 MHz. For performance, *Microprocessor Report* rates high-end MIPS chips slightly behind HP PA/RISC and Alpha but slightly ahead of SPARC chips.

IBM RS/6000 and PowerPC. IBM introduced a whole line of RISC workstations in early 1990 based on their RS/6000 processor chip set. Not a single

CPU chip, the original RS/6000 processor design uses seven or nine separate chips, depending on configuration. With up to 7.4 million transistors, the RS/6000 implements an advanced superscalar design allowing up to four instructions to be simultaneously issued if conditions permit. Still short of high-end HP PA/RISC or Alpha performance, the RS/6000 delivers superb floating-point performance. Using four separate 16K data cache units and an 8K instruction cache in the maximum configuration, the RS/6000 is still a 32-bit design. IBM also provides a scaled-down single chip version of the RS/6000 called RSC (RISC Single Chip).

The joint venture announced between Apple, IBM, and Motorola in late-1991 specified the joint development of single-chip versions of the RS/6000 processor architecture deemed the PowerPC. The PowerPC architecture will allow convergence of Apple's and IBM's product lines in terms of software support. Future Macintosh systems based on the PowerPC chip will be able to run RS/6000 software in addition to native 68000 binaries via emulation software. IBM PowerPC stations will run RS/6000 software in addition to existing MAC binaries. Pink, the next generation of object-oriented operating system being developed by IBM and Apple, will also run in PowerPC systems.

Using bus-interface technology from Motorola's own 88110 RISC processor and IBM's RSC core logic, the first PowerPC chip, called the "601," was formally announced in October, 1992. Implemented with a 0.6-micron CMOS process and housing 2.8 million transistors, the 32-bit 601 chip will run at either 50 MHz or 66 MHz. The PowerPC uses a 32K unified instruction/data cache, which is not the norm in RISC designs, but its eight-way set-associative configuration should improve hit rates. Superscalar techniques (three-issue maximum) are also carried over from the RS/6000 technology, and the 601 chip features 3.6-volt and 9-watt operation (at 50 MHz) for use in notebooks. □

bit QuickDraw technology. With an active-matrix portable or high-resolution monitor, the result is photographic-quality images for detailed renderings, simulations, and animations. QuickTime multimedia extensions take graphics a step further by letting users play movies on Macs, as well as cut, copy, and paste audio and video clips.

The Mac's built-in audio support also distinguishes it from a PC, allowing for voice input to word processing, spreadsheet, and presentation applications. Most PCs require add-in sound cards and software. Balloon Help, an interactive tool that lets users get information about an item by pointing to it on-screen, is also part of the operating system.

The Mac's Finder program can access files and folders anywhere on the Mac through a variety of search criteria. Finder also has a customizing feature that lets users organize their machines for instant access to files and applications. This feature, called aliasing, gives users access to an application in more than one place on the Mac.

The Quadra 800 comes with a built-in Ethernet port. And AppleTalk—the Mac networking protocol—is built into every Mac, which allows for use of network printers, file sharing with other Macs, and e-mail access. The Mac also has a built-in file-sharing capability that lets users share files and folders on the same network without a dedicated server. Files can be shared with Macs and PCs. Microsoft is providing peer-to-peer networking in its new Windows for Workgroups program, which most likely will be incorporated into Windows NT in the future.

Apple's Data Access Language (DAL) lets Mac users access remote databases through built-in extensions. Using DAL, users can extract information from minicomputers and mainframes transparently via the Mac interface. Microsoft's counter to DAL is ODBC (Open Database Connectivity).

CONCLUSIONS

Under Taligent, the Apple/IBM alliance, a new operating system based on object-oriented programming (called Pink) is being developed. Future Macs will be based on the PowerPC chip, an extension

of IBM's RS/6000 chip technology being built by Apple, Motorola, and IBM. PowerPC systems will run a future version of System 7.1 as well as Pink. It is unclear how the Apple and IBM product lines will evolve, but each company says it will have its own offerings.

Increasingly, Apple has focused on the corporate market, which is why it has introduced server solutions. Apple's alliance with IBM will help give the Mac greater connectivity (and legitimacy) within corporate environments.

Hewlett-Packard Co.

HP Apollo 9000 Model 715/50

BY DAVID WILSON

Performance is what sells workstations, and since the introduction of its HP Apollo 9000 Model 730 CRX system in early 1991, Hewlett-Packard has held the performance lead among desktop workstations and is one of the leaders in total workstation sales, trailing only Sun Microsystems. It is unusual for a company to hold a performance lead this long in the rapidly changing workstation market. The dominance of HP's Precision Architecture (PA)/RISC chips, however, is being challenged by Digital Equipment Corp.'s new Alpha processors, which boast clock speeds of up to 200 MHz.

The HP workstation line is geared toward compute-intensive scientific and engineering applications, where floating-point performance is critical. The model tested, Model 715/50, offers 13.2 MFlops of floating-point performance (which compares with the high-end Model 735's 40.8 MFlops), while a typical Intel 80486 33-MHz PC scores from 1 to 2 MFlops.

All machines in HP's 9000/700 series are based on HP's PA/RISC chips, of which there have been two implementations. The first PA processors had a separate CPU and FPU (floating-point unit). The more recent 710s, including the Model 715/50, have an integrated FPU. A broad range (in price and perfor-

mance) of HP machines are built from these chips.

The unit tested lands in the middle of HP's workstation line in terms of price and performance—placing it in the upper performance range among workstations in general. A Model 715/50 with a 1GB hard disk, 32MB of RAM, and a 19-inch color monitor is priced at \$17,240. It uses a 50-MHz 7100 processor chip and has a 64K instruction and data cache.

While the machine's configuration would be at the very high end of the PC spectrum, it is only a typical workstation system. HP's high-end desktop system is the Model 9000/735CRX, which is \$38,940 with a 19-inch color monitor, 32MB of RAM, and a 1GB hard disk.

The Model 715/50 is equipped with a standard EISA-bus slot, space for two 3.5-inch internal disks, and a removable media device. The machine comes with two RS-232 ports, a centronics parallel port, an external SCSI-2 port, an Ethernet LAN interface, and audio input/output. Each of the two internal disk bays

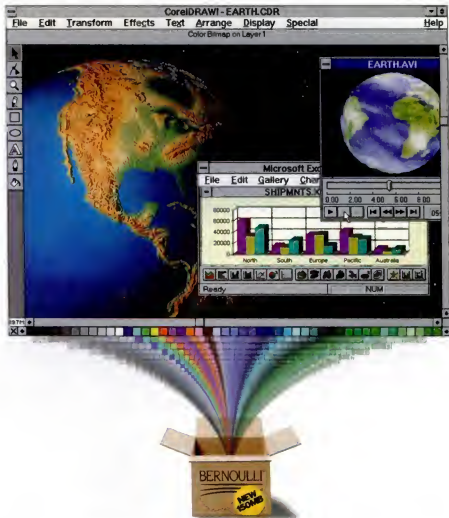


The Apollo 9000, with its 50-MHz PA/RISC chip and smooth HP/UX user interface, offers super bang for the buck and impressive graphics capability.

can house a 1GB disk, allowing 2GB of internal storage and as much as 68GB total storage via external drives. Memory size ranges from 16MB to 256MB. The EISA bus slot can be used for another LAN interface or SCSI-2 interface.

PERFORMANCE

The Apollo 9000 was a pleasure to use. Its operating system and compilers were reliable, and we were able to set it up and connect it to a LAN in just a few minutes. Windows opened and closed rapidly,



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Unix commands were executed quickly, and applications ran faster than they did on other workstations. Part of this performance is due to HP/UX, HP's version of Unix. But HP's 9000/700 series machines also have the fastest 2-D graphics hardware available at any price level, and the hardware makes users' lives more pleasant through the responsive graphical user interface.

Two-dimensional X11 graphics performance was outstanding. We measured 860,000 10-pixel vectors per second using normal software programs. This is twice the performance of most other workstations and perhaps 10 times the speed of typical PC VGA displays.

HP has done an excellent job of pricing its machines according to their performance. Whether a unit's performance is measured in SPECmarks, MFlops, Dhrystones, or Khronstones, workstation price/performance ratios are constant across the HP product line. The current

price/performance level of HP's line is twice as attractive as that of the 9000/700 series workstations introduced in 1991. The high-end Model 735 has about twice the performance of the Model 715/50, which in turn has about twice the performance of the Model 705. The Model 735 has dual 256K instruction and data caches, a 99-MHz processor, up to 400MB of RAM, two internal storage devices, and SCSI-2 and "fast and wide" SCSI-2 interfaces as standard.

SOFTWARE APPLICATIONS

There are several thousand software applications available for HP machines from third-party suppliers. They range from word processing and spreadsheet software to advanced engineering applications. HP primarily provides operating system, language, graphics, and communications programs. Although there are many software applications available for HP machines, there are not nearly as many varieties of packages as there are for popular applications in the PC arena.

HP's System Administration Manager (SAM) is a menu-driver shell that lets users perform most tuning and administration functions without requiring that they know the underlying operating system file requirements. The HP/UX operating system permits file striping across multiple drives, which boosts performance and allows users to build large file systems (the total size is the combined size of all the striped disk drives). File system performance increases almost linearly with the number of hard disk drives striped, at least through four or five drives. SCSI disk rates of 6MB to 12MB per second are possible when using a fast and wide SCSI interface working with multiple striped hard disks.

CONNECTIVITY

HP workstations all support Ethernet LANs, and those with an EISA slot can support Token-Ring and Fiber Distributed Data Interface (FDDI) networks.

We were impressed that the HP Apollo 9000 lets users change from one LAN configuration to another by merely swapping a board (a 5-minute task) and changing a simple set of software administration menus (another 5 minutes). At this

point, the machine is fully operable with all its software on a completely different network.

Three HP packages offer different ways of connecting to DOS machines. For PC users, HP offers a DOS emulator called SoftPC. We saw a tenfold difference between native

Unix performance and emulated PC performance, but HP's SoftPC is able to achieve a relatively faster speed, depending on the model used. For workstation users who occasionally run DOS applications, this performance is acceptable. Insignia Solutions (the developers of SoftPC) will soon be offering a SoftPC upgrade that will run Microsoft Windows, Version 3.1, in enhanced mode.

HP LAN Manager/X lets a workstation act as a file and resource server for PCs running DOS, Windows, and OS/2. The package provides file and peripheral sharing, printer spooling and management, station-to-station messaging, and APIs (application programming interfaces) for program development. HP also supports a NetWare product that provides a fully NetWare-compatible server. HP's adherence to network standards also allows a variety of third-party packages, running on DOS machines, to access HP workstations transparently across a network.

CONCLUSIONS

The drawbacks to the Apollo 9000 (and to workstations in general), are its price and the limited availability of general office applications. The cost of HP mid-range workstations can be justified primarily for their FPU-intensive, scientific, and engineering applications, such as CAD and CAM. The Apollo 9000 also makes a terrific LAN server. Database applications that are CPU and disk inten-

SUITABILITY TO TASK				
HP Apollo 9000 Model 715/50				
	POOR	FAIR	GOOD	EXCELLENT
Applications development	●	●	●	●
Connectivity	●	●	●	○
Engineering/scientific/ 2-D CAD	●	●	●	●
Desktop publishing	●	●	●	○
3-D graphics	●	●	●	○
Office productivity	●	●	●	○

FACT FILE

HP Apollo 9000 Model 715/50

Hewlett-Packard Co., Direct Marketing
Organization, P.O. Box 5809, Mail Stop
511L-JJ, Santa Clara, CA 95051-0859;
800-752-0900

List price (tested configuration): \$17,240

Motherboard and CPU: HP PA/RISC 7100, 50 MHz;
32MB RAM; 64K instruction and 64K data cache.
Storage: 1GB hard disk; 8GB tape drive.

Display: 1,280-by-1,024, 12MB VRAM, 19-inch color
monitor.

Graphics controller: CRX integrated controller.

Network adapter: Built-in Ethernet support.

Software: HP-UX 9.0; PEX, PHIGS, Starbase; GKS. HP
Fortran 9.01 (\$2,095); switches used: +03 +0P4 (for
most tests), HP C 9.00 (\$2,090); switches used: +03.
Graphics library: X11.

In short: The HP Apollo 9000, arguably the best all-around performer in the roundup, was at or near the top in virtually every performance category. While the price of the HP tends to match similarly configured workstations, the performance of the HP is generally better, resulting in a better overall price/performance value. The higher cost of an HP midrange workstation, as opposed to an Intel-based PC, can be justified primarily for floating-point-intensive scientific and engineering applications (such as CAD/CAM).

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sive may make effective use of the power of a machine like the Apollo 9000. Also, some network-related applications can benefit from the use of this type of machine. Most users, however, do not yet need this kind of power.

As with most product lines, choosing an HP workstation involves a trade-off between price and performance; more money buys you a substantially faster system with more expansion capabilities. But while the pricing of HP units tends to match that of similarly configured machines from other vendors, the performance of HP machines is generally higher. In terms of price/performance alone, an Intel PC platform may still look more attractive, but based solely on performance, an HP unit is a solid choice.

IBM Corp.

IBM RS/6000 PowerStation 365

BY DAVID WILSON

Like Hewlett-Packard Co., IBM Corp. is selling performance in its workstations. Since the introduction of the RS/6000 line in 1990, IBM has more than tripled the systems' performance—a pace that has kept its machines competitive. RS/6000s are mainly installed in scientific/engineering environments, and IBM has introduced multiprocessor systems that are aimed at high-end scientific applications.

As a result of IBM's size and considerable marketing clout, a number of its RS/6000 systems have also been sold into multiuser commercial environments. The power of the systems, when combined with broad network offerings and RS-232 communications interfaces, enable an RS/6000 to serve a number of terminals. The raw performance of the systems is generally acceptable for database or general business applications, and several vendors offer RS/6000 server-based image systems that support multiple PC clients running Windows (such as Bull,



The PowerStation 365's floating-point prowess makes it a top contender in the CAD/CAM arena. RS/6000 technology is the basis for PowerPC chips being developed by IBM, Motorola, and Apple.

FileNet, IBS, Plexus, and Wang).

PowerStation performance ranges from the 25-MHz PowerStation 320H to the 62.5-MHz PowerStation 375. The PowerStation 365 that we tested has a 50-MHz clock rate. Priced at \$23,435, it includes two serial ports, one parallel port, a SCSI interface, integrated Ethernet, a 1GB SCSI drive, and a Gt4e graphics card. It also has one MicroChannel bus slot and 32MB of RAM. A keyboard, mouse, and 19-inch color monitor complete the system. AIX, IBM's version of Unix, is bundled with the system (previous RS/6000 systems required AIX to be ordered separately).

The PowerStation 365 is the middle offering of three newly introduced RS/6000 desktop systems that range in price from \$15,995 to \$25,495. On the high end, RS/6000 PowerServers can have anywhere from 16MB to 128MB of RAM and range in price from less than \$10,000 to more than \$100,000. Other than clock rate, the key differentiating factor among the various RS/6000 models is cache size. RS/6000s use small caches. The PowerStation 365 has a 32K data and 32K instruction cache, which is the largest cache available on an IBM desktop system. Despite the small cache size, the PowerStation 365 did well

on most application and performance tests. Other workstations, such as the Sun SPARCstation 10 Model 41, have a 1MB external cache and an internal cache. Cache size alone does not necessarily determine system performance; system design is also crucial.

The future of the Power architecture looks good on the low end, with Apple Computer and IBM collaborating on the RS/6000-based PowerPC chip and Apple adopting RS/6000 chips for some of its systems. Continued clock-rate or architectural improvements in mid-range systems like the PowerStation 365 will be required to keep RS/6000 machines in the forefront of the workstation market.

PERFORMANCE

The PowerStation 365 showed excellent floating-point and disk performance. Only HP workstations can compete with RS/6000 systems in floating-point calculations. In integer and disk performance, the PowerStation 365 did well, but it did not stand far above other similarly priced systems. HP, Silicon Graphics, and Sun workstations have similar or better integer performance.

While past IBM workstations have been relatively weak in graphics capability, the PowerStation 365 comes with IBM's Gt4e accelerated graphics card. It showed good performance on application tests but slow response in Microsoft Windows operations. Although a PowerStation 365 equipped with a Gt3 card is an acceptable performer, it trails the fastest midrange graphics systems.

When we ran the SPECmark suite of tests on the PowerStation 365, we achieved only about 80 percent of the unit's claimed floating-point performance and a somewhat higher percentage of CPU performance. IBM's compilers generate excellent code, but the sheer number of options presents a problem. Achieving optimal performance requires a great deal of effort by the developer. Other vendors' machines (such as the Sun and Silicon Graphics units) also have this type of compiler library problem.

SUITABILITY TO TASK	
IBM RS/6000 PowerStation 365	
	POOR FAIR GOOD EXCELLENT
Applications development	● ● ● ●
Connectivity	● ● ● ●
Engineering/scientific/ 2-D CAD	● ● ● ●
Desktop publishing	● ● ● ●
3-D graphics	● ● ● ●
Office productivity	● ● ● ●

price from less than \$10,000 to more than \$100,000. Other than clock rate, the key differentiating factor among the various RS/6000 models is cache size. RS/6000s use small caches. The PowerStation 365 has a 32K data and 32K instruction cache, which is the largest cache available on an IBM desktop system. Despite the small cache size, the PowerStation 365 did well

FACT FILE

IBM RS/6000 PowerStation 365

IBM Corp., Old Orchard Rd.,
Armonk, NY 10504; 800-426-3333

List price (tested configuration): \$23,435

Motherboard and CPU: Power, 50 MHz; 32MB RAM; 32K instruction and 32K data cache.

Storage: 1GB hard disk, two 1.44MB 3.5-inch SCSI drives, 1.44MB 3.5-inch floppy disk drive.

Display: 1,280-by-1,024, 19-inch color monitor.

Graphics adapter: G4e accelerated graphics card

Network adapter: Built-in Ethernet

Software: AIX, Version 3.2.3, IBM XL Fortran 2.2.1 (\$1,520); switches used: -O (except for some SPEC tests) IBM XL C 1.2; switches used -O. Graphics library: X11.

In short: Although we experienced some problems, our overall impression of the IBM RS/6000 PowerStation 365 was positive. It is ideally suited for floating-point-intensive engineering and scientific applications, and can serve as a strong multiuser business system. In CPU and graphics performance, the RS/6000 is competitive with other workstations and outdistances PCs. It is in the upper range of IBM RISC performance at a moderate workstation price. As configured, the system offers good value. Its price/performance ratio is four times better than that of the first RS/6000 systems.



ON READER SERVICE CARD

Only HP's compilers achieved close to the claimed SPECmark performance.

Our PowerStation 365 developed an operating system problem when an application (Cadam) was removed from the system. Something had been disturbed, and a substantial portion of the disk was not allocated. SMIT (System Management Interface Tool), IBM's system administration utility, was unable to reallocate the disk space until we discovered the correct pair of commands. What should have been a simple process took several hours to fix.

SOFTWARE

AIX is an unusual version of Unix, with a number of advanced features and peculiarities. Although IBM's documentation is hefty, we regularly ran into problems or commands that were not covered. Our experience with other Unix versions did not translate easily, and we ended up placing more calls to IBM support than

we would have liked. Unlike most competitive Unix versions, however, the size of AIX files can be expanded after the system is set up, which we found useful.

AIX is a large operating system, and the installation process is both complex and time consuming. It is daunting to run out of room on a 400MB hard disk when installing only the operating system, an X11 graphics library, and an optional compiler. Although AIX is now a bundled option on the three new PowerStations, users may have to install AIX upgrades. A 1GB hard drive in an RS/6000 that is being used as a development system should not be considered overkill.

The PowerStation 365 has a powerful information utility called InfoExplorer. Beyond the usual manuals that Unix systems have on-line, InfoExplorer gives full access to IBM manuals. It has a variety of access modes for finding information in context and appears to be the most powerful of the retrieval systems available in the workstation market. InfoExplorer comes bundled with AIX, which differs from the optional information utilities of other vendors (such as Sun). With SMIT, an administrator can add peripherals, control the file system, add users or software, and control nearly all aspects of the system configuration and operation.

CONNECTIVITY

The PowerStation 365's networking performance was strong on some tests and weak on others. Using a Sun 630 MP as a server, performance tests run on the IBM system showed only fair NFS (Network File System) performance.

As an "open system" vendor, IBM supports a number of standard Unix facilities. Thus, PCs that support TCP/IP or NFS can connect to RS/6000 networks, and a PC running an X11 server can connect to RS/6000 machines without problems. IBM provides a DOS emulator under AIX, as well as a solid portable NetWare offering. An AIX version is available for Intel-based PS/2 systems, which provides a parallel development and runtime environment across the PS/2 and RISC lines.

CONCLUSIONS

Although we experienced some problems, our impression of the PowerStation 365 was positive. Like the HP workstation we tested, the PowerStation 365 is ideally suited for floating-point-intensive engineering and scientific applications. The workstation also can serve as a strong multiuser business system. In CPU and graphics performance, it is competitive with other workstations and far outdistances PCs.

As with any system evaluation, the key issues involved here are performance, price, and application availability. The performance of the PowerStation 365 is excellent, but the cost is high. As PC systems such as Pentium-based machines reach higher levels of performance, increasing numbers of applications once suited for workstations are becoming viable on PCs. Although there will always be applications that require workstation power, a greater percentage of applications will fall within the performance range of low-cost systems. While there are many applications currently available for RS/6000 systems, the PC market offers more choices among popular programs.

Silicon Graphics Inc.

Silicon Graphics Iris Indigo R4000 XZ

BY DON CRABB

Silicon Graphics. The name really says it all. These Unix workstations are justly fa-



Silicon Graphics' Indigo XZ is the champion of 3-D graphics. Silicon Graphics machines are being employed by Hollywood studios to produce dazzling movie special effects.

mous for their prowess at churning three-dimensional graphics rasters faster than you can say, "Render me." For this roundup, we chose to test a Silicon Graphics Indigo R4000 XZ, which at \$30,200 cost the most of any of the machines that we looked at.

What do you get for all that money? Workstation Labs' tests proved that you get extremely fast graphics performance—orders of magnitude faster than the Compaq and Sun units tested and considerably better than the IBM and Hewlett-Packard offerings here. The Indigo XZ also proved to be fast at cranking out floating-point operations, and it was simply stellar on the Khornerstone tests. We can give you the bottom line on the Indigo XZ up front: Buy one if you absolutely must have top floating-point and graphics performance—and you don't care about price.

GRAPHICS PERFORMANCE

The tested Indigo XZ included 32MB of RAM, a 16K processor cache, a 1.2GB SCSI hard disk drive, built-in Ethernet, and built-in Networked File System (NFS) capability, as well as the Silicon Graphics Irix 4.0.5 version of Unix. The Indigo XZ we looked at had a 19-inch color monitor with 1,280-by-1,024 resolution, 24-bit color depth, a hardware Z buffer (which further speeds up graphics redraws), and an XZ-24 graphics engine. C language (\$1,200) and FORTRAN compilers (\$1,195) are options with the Indigo XZ, as is the NFS (\$595).

If you plan to render 24-bit images, edit audio and video data, or do integrated media publishing, the Indigo XZ may not be enough for you. Fear not, however. Simply double the price and buy an Indigo2 Extreme with a MIPS R4400 150-MHz CPU and the Extreme graphics option. The Extreme graphics engine in the Indigo2 Extreme rolls together eight Geometry Engine processors for providing 24-bit display color and a 24-bit color frame buffer.

SOFTWARE

What defines an Indigo XZ (besides its stellar floating-point and graphics performance) is its Irix operating system, which is based on IEEE Posix 1003.1 and AT&T System V, Release 4, Unix versions (which include the University of California at Berkeley's BSD 4.3 enhancements). Irix, Version 4.05, includes the X11 Windows package, which is a nice version of OSF/Motif (with the Motif Window Manager

and Display Postscript).

Irix also includes the Iris GL graphics extensions; the Iris Showcase audio, video, and hyperlink extensions for doing color presentations; ImageVision; Iris Explorer; and Media Mosaic. All of these make it easy to manipulate images and image libraries.

CONNECTIVITY

The Indigo XZ is no Unix slouch either. Irix comes with all the usual Unix connectivity pieces: TCP/IP, NFS, Ethernet, and many others you might not expect in a Unix box, including Fiber Distributed Data Interface (FDDI), DECnet and LAT emulators, TCP 3270 and SNA 3270 emulators (for those of you who must have IBM 3270-style connectivity), and Macintosh EtherTalk.

SUPER SILICON GRAPHICS

Silicon Graphics plans to expand the supercomputer market by bringing prices below a million dollars per machine and by focusing on its traditional graphics, scientific, engineering, and entertainment markets. Some existing Silicon Graphics workstations, such as a full-blown Indigo2 Extreme, can be considered supercomputers. This all bodes well for potential buyers if they are considering incorporating today's Silicon Graphics workstations into their environments and eventually want a software growth path to true supercomputers.

PowerChallenge, a new line of RISC-based supercomputing servers, includes

the L model and the XL model, which will have up to 5.4 gigaflops of peak performance. Starting prices range from about \$120,000 to \$170,000, and the products will be available by the first half of 1994. Challenge, a line of servers that includes up to 36 processors, shipped during the first half of 1993; prices range from \$20,000 to \$120,000. Onyx should be ten times more powerful than any previous Silicon Graphics workstation (including the Indigo2 Extreme) and will include two graphics subsystems: RealityEngine2 and VTX. Onyx will be available later this year; prices will range from \$114,900 to \$634,900. Each of these systems is based on the single-processor MIPS R4000 chip set or the symmetrical multiprocessing MIPS R4400, developed by

SUITABILITY TO TASK				
Silicon Graphics Iris Indigo R4000 XZ				
	POOR	FAIR	GOOD	EXCELLENT
Applications development	●	●	●	○
Connectivity	●	●	●	●
Engineering/scientific/2-D CAD	●	●	●	○
Desktop publishing	●	●	●	●
3-D graphics	●	●	●	●
Office productivity	●	●	○	○

FACT FILE

Silicon Graphics Iris Indigo R4000 XZ

Silicon Graphics Inc., 2011 North Shoreline Blvd., P.O. Box 7311, Mountain View, CA 94039-7311; 800-800-4744, 415-960-1980; fax, 415-961-0595

List price (tested configuration): \$30,200.

Motherboard and CPU: MIPS R4000SC, 50 MHz (100 MHz internal), 32MB RAM; 8K data cache and 8K instruction cache

Storage: 1.2GB hard disk, .25-inch 150MB tape drive, internal 3.5-inch floppy disk drive, external CD-ROM drive

Display: 1,280-by-1,024, 24-bit Z buffer, 5MB VRAM, 19-inch color monitor.

Graphics subsystem: XZ Graphics, including a raster engine processor and two Geometry Engine processors.

Network adapter: Built-in 10BaseT Ethernet support, optional FDDI support.

Software: Irix 4.05, Iris Showcase 2.0 presentation graphics; Media Mosaic digital media tools; Iris Insight on-line documentation; OpenGL, implementation of Iris Graphics Library; Silicon Graphics Fortran 3.10 for most tests (\$1,195), switches used -O3 for most tests; Silicon Graphics C 3.10 (\$1,200) for most tests; switches used -O3 for most tests; Graphics library: X11, GL.

In short: Because of its connectivity prowess, stellar graphics, floating-point performance, and multimedia capabilities, a Silicon Graphics Iris Indigo R4000 XZ makes a good investment for a PC owner who is interested in building a graphics workstation for specialized work.

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MIPS Computers Systems (which became a wholly owned subsidiary of Silicon Graphics last year).

CONCLUSIONS

You might buy an Indigo XZ to run a high-end desktop publishing program such as Interleaf, PageMaker, or FrameMaker. You could also buy it to run the expensive 3-D graphics and CAD software that you could run on a Sun SPARCstation LX, HP Apollo 9000, or IBM RS/6000. In both categories, the Indigo XZ does an excellent job.

A better reason to buy an Indigo XZ, however, is so that you can run those types of applications in concert with real-time image processing, 3-D modeling, and animation software (the unit does an absolutely beautiful job of performing advanced graphics like texture mapping, object transparency, spotlighting, alpha blending, full-scene antialiasing, and ray tracing).

The Indigo XZ handles video and audio with aplomb and is clearly equal to or better than an Apple Macintosh Quadra at doing so. You can add in an Indigo Video board to digitize low-end video, or you can configure your Indigo to work with broadcast-quality video and audio sources. The Indigo XZ's dedicated video bus screams along at a maximum transfer rate of 133MB per second. At those speeds, you don't have to worry about video and audio compression and the artifacts they leave.

In fact, one excellent way to use the Indigo XZ would be to use it as a miniature desktop recording studio. Indigo machines support 24-bit digital and 16-bit analog stereo sound while handling line and microphone analog inputs and outputs. The board uses a 56001 digital signal processor to handle real-time data transformations, and the multiprocessing Irix operating system interfaces with the board without wasting CPU cycles.

Because of its connectivity prowess, stellar graphics, floating-point performance, and multimedia capabilities, an Indigo XZ makes a good investment for a PC owner looking to build a graphics workstation for specialized work that even a Pentium-based PC, Macintosh Tempest, or Cyclone wouldn't be able to manage.

Don't think of the Indigo XZ as a

high-end PC, however, because like the other Unix workstations tested here, it is not. You still have to deal with user and management problems that even a nice Unix like Irix can present (not the least of which is the hassle of what should be simple software installation). The Indigo also lacks the multiplicity of applications provided by a Compaq or a Quadra, although Silicon Graphics' catalog of available third-party productivity applications beats the HP, IBM, and Sun catalogs hands down.

The Indigo XZ was the fastest machine tested at 3-D graphics, but it was also the most expensive. It handled floating-point calculations very well, making it both suitable for engineering and scientific environments, as well as a good choice for power desktop publishing. It's no wonder that Indigos are so often used by Hollywood firms for animation renderings. (An Indigo workstation was used to create the magnificent photographic-quality background of the ballroom dancing scene in *Beauty and the Beast*.) Because of the growing cadre of productivity applications, the Indigo XZ can also do double duty at basic office computing. But considering its hefty price tag, it ought to.

Sun Microsystems Inc.

Sun SPARCstation LX

BY DON CRABB

We might as well cut to the chase. Most PC owners won't buy a Sun SPARCstation LX anytime soon. In fact, we don't think Unix fans will be enthralled with this machine either. It was the slowest among the Unix workstations on almost every performance test. Although it was also the cheapest Unix workstation tested, its price/performance ratio was not impressive and was easily eclipsed by that of the Compaq Deskpro 5/66M unit running SCO Unix.

Our tests showed that if you really want solid Unix workstation performance from a Sun, you need to buy a machine at the same level as the other

Unix boxes tested here: the HP Apollo 9000 Model 715/50, the IBM RS/6000 PowerStation 365, and the Silicon Graphics Iris Indigo R4000 XZ. For that kind of money (\$17,240-\$30,200), you can buy a Sun SPARCstation 2-class machine of similar performance.

The SPARCclassic is a much better



Sun's low-end SPARCstation LX is best suited as a PC server or Sun network client, thanks to its excellent PC connectivity and networking tools.

buy than the SPARCstation LX, and unless you really need the graphics acceleration, it will fit just fine into an existing Sun Networked File System (NFS) server Ethernet network.

Many PC users are in a quandary as to when and why they might buy a SPARCstation LX. You should not think of SPARCstations as ultra high-end PCs. There is still a difference between high-end PCs (like the Compaq we tested) and desktop Unix workstations. You should not buy a SPARCstation LX simply to try to run word processing and spreadsheet programs faster than you would on your current PC—that would be a waste of computing resources. Unless you have a specific application or configuration that needs Sun's Unix NFS server-based workstations, look elsewhere.

SPARCSTATION 2 PERFORMANCE

On our floating-point, integer, disk I/O, and multiprocessing tests, which gauge a computer's ability to run engineering and scientific applications quickly, the SPARCstation LX came up short. As you can see from the test scores, it ran slower than the Deskpro 5/66M, the HP Apollo 9000, the PowerStation 365, and the Indigo XZ in nearly every low-level perfor-

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■ PowerPC: *A Look at the Future*

by Don Crabb

Fast forward to January 1994. Probably with a megablockbuster commercial run during the Super Bowl, Apple will introduce the new Macintosh. The machine will be based on the PowerPC RISC architecture that Apple, IBM, and Motorola have banded together to produce as part of their Taligent venture.

The guts behind the PowerPC will be the new 32-bit PowerPC 601 CPU, which is based on the RISC chips IBM uses in its RS/6000 Unix workstations. The PowerPC 601 is the first of at least four such PowerPC 60x chips being developed.

The first PowerPC Mac will probably incorporate a version of the 601 chip running at about 50 MHz, with 8MB of RAM, a 2.8MB floppy disk drive, and built-in support for 16-bit color. Apple will include a processor-direct slot but no Nubus expansion bus. Like the 68040-based Cyclone and Tempest Macs expected this summer, which will use digital signal processing (DSP), it will feature a new high-performance I/O subsystem.

The specifications have not yet been set for the PowerPCs, but Apple's current plans call for an entry-level system that will deliver three or four times the performance of the Quadra 800 at a discount price of \$3,500.

The PowerPC 601 will be used in low-end IBM Unix workstations (which will most likely run the OS/2 operating system, IBM's AIX Unix, and a version of Macintosh Finder) and will serve as the basis of the next generation of Mac systems.

This RISC chip, which will differ radically from the 680x0 CISC chips used in current Macs, will be at the heart of the new Macs. At this point, you might be wondering how a CPU unfamiliar with Apple's system software could possibly serve as the heart of the new Macs. Welcome to the won-

derful world of software emulation. A Mac can act like a DOS machine by using a DOS emulation program like SoftPC or SoftAT (both from Insignia Solutions). SoftPC presents a standard DOS interface to DOS software (including Windows), so that the application thinks it's running on an Intel x86-based DOS CPU. SoftPC does this by translating the Mac's Motorola 680x0 instructions and its System Toolbox routines into DOS BIOS (Basic Input/Output System) and Intel x86 instructions. The same kind of software emulation occurs in the SoftPC products that run under various forms of Unix.

The problem with emulation as it's currently practiced is that it needs to be orders of magnitude faster to really pull off the illusion. So what happens when you run SoftPC Pro (the high-end version of SoftPC) on a Quadra 950? You get a DOS window that acts as though it were being displayed by a \$699, bargain-basement Intel 286 DOS clone, rather than on a nearly \$10,000 workstation.

Into this territory Apple dares to tread with its PowerPC architecture. PowerPC chips are screamers, but they know nothing about a Mac or about how System 7.1 works. Nor are they familiar with ToolBox, QuickDraw, Finder, or any of the other software underpinnings of the Mac.

Apple has two ways to tackle this problem. First, it can make its software vendors write new versions of their software that work directly with the new PowerPC chips and essentially leave behind all of today's loyal Mac customers. Or, it can come up with a software emulator that runs on the PowerPC chip and makes Mac software think it's running on a regular Motorola 680x0.

Apple has chosen both strategies. It is working with a company called Echo Logic to come up with as fast a Mac

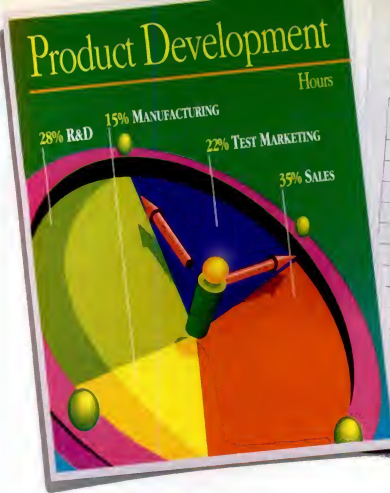
System emulator as it can for the PowerPC chips. At the same time, it's helping software vendors rewrite their applications to work with the new chip. Apple expects Echo Logic's emulation software to work fast enough so that users who buy the 1994 "PowerMacs" won't feel they were gypped buying machines that don't run the software to its full potential.

Right now, the emulator on a prototype PowerMac runs Mac software at about the speed of a standard Macintosh IIci. This isn't exactly world-class performance, but it's acceptable—or so Apple believes. What Apple really wants is to get people hooked on the potential of superfast PowerMac performance (when native mode—application software becomes available)—without forcing PowerMac customers to dump their existing Mac software to buy new PowerMac programs.

There are lots of leaps of faith in Apple's strategy, of which you should be aware when doing your planning. To make the whole enterprise viable at an early stage, software vendors must field native-mode PowerMac versions of their applications in 1994. When, however, was the last time software vendors got new products out on time?

There's no doubt in our minds that Apple will eventually convince the majority of its installed base to buy PowerMacs and PowerMac applications. But there will always be a core group of MacFolk who want to wring the last bit of use out of their current machines before they hop aboard the PowerMac bandwagon. So it's unclear if—and when—Apple will drop 680x0 Macs from its line (after all, Apple still makes Apple IIs!).

The PowerPC will finally make Apple a real player in the computing performance game. And for potential Unix workstation buyers, it will add one more variable to an already overburdened selection equation. □



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mance test. It did excel on some graphics performance tests and on the recursive part of the Stanford multiprocessing tests, a showing indicative of good client/server behavior. This makes the unit a good choice to serve as a client in a large network, perhaps for SQL database applications. Another good use of a higher-end SPARCstation LX would be as a server for a group of PCs running graphics software.

The Sun SPARCstation LX we tested ran Solaris 2.1 as the OS, with Sun's FORTRAN 2.0.1 and C 2.0.1 in workstation performance testing. There are dozens of other SPARCstation platforms, which range from lower-performance, diskless desktop units such as the SPARCstation ELC (less than \$3,000) to high-performance, rack-mounted, tower SPARCstations in multiprocessor configurations (priced at more than \$100,000 for systems with more than four SPARCstation CPUs and niceties such as built-in Fiber Distributed Data Interface fiber-optic networking).

SOLARIS 2.1

Solaris 2.1 includes the multiprocessing SunOS 5.x, which is based on Unix System V, Release 4. Solaris also includes a windowing system environment called OpenWindows, coupled with a graphical user interface called OpenLook and DeskSet; Sun Open Network Computing modules, which include NFS and the TCP/IP networking protocols; and a set of object-based development tools.

This full suite of systems software and tools is included with the SPARCstation LX and is one of the reasons that you need plenty of disk space in order to run SunOS. It is also one of the reasons that you might purchase a Sun workstation. Solaris 2.1 stands as one of the most solid of the Unix implementations currently available and provides stiff competition for the other 32-bit operating environments (such as AIX, A/UX, System 7.1, and Windows NT).

Sun is moving its own operating system prowess toward multiple compatibility. You can already run DOS applications on your SPARCstation LX using a third-party emulation package from Insignia Solutions called SunPC. You will soon be able to run Solaris 2.0 on 486- and Pentium-based PCs, while also running native-mode DOS applications.

Because Solaris is Unix, it works with all the usual Unix methods of sharing data and passing control among applications (like pipes, multithreaded program execution, and preemptive multitasking). You could also use a third-party networking OS, such as NetWare or AppleTalk, to complete the Sun-to-PC connection. The SPARCstation LX can also read and write DOS 3.5-inch floppy disks directly and can even run DOS software through the use of a third-party DOS emulator like Insignia SunPC. Simple serial connections can also be made with the SPARCstation LX.

Unix, of course, doesn't need some of the clumsier interapplication communications (IAC) techniques now being used by Apple's System 7.1 (Apple Script, Apple Events) and Microsoft Windows (OLE, DDE) to get around those systems' basic operational deficiencies. From a user's point of view, however, those IAC techniques are more directly controllable than are Unix's fairly arcane mechanisms. This is one reason Sun is putting so much effort behind Object Request Broker (ORB), which it has been developing with Hewlett-Packard over the last two years. Sun hopes to bypass the fairly elementary IAC implementations by going directly to true plug-and-play object modules that users can use to build their own applications on the fly. (Apple and IBM are seeking the same prize with their Taligent/Pink initiative and PowerOpen development.)

APPLICATIONS SOFTWARE

You will find more CAD and high-end graphics applications for the SPARC-

FACT FILE

Sun SPARCstation LX

Sun Microsystems Inc., 2550 Garcia Ave.,
Mountain View, CA 94043; 415-336-0600;
fax, 415-969-9131

List price (tested configuration): \$9,565.

Motherboard and CPU: microSPARC, 50 MHz; 24MB RAM, 2K data and 4K instruction cache.


Storage: 424MB hard disk, 3.5-inch 1.44MB floppy disk drive, CD-ROM drive

























Display: 1,152-by-900, 1MB VRAM, 16-inch color monitor.

Graphics controller: GXplus integrated controller.
Network adapter: Built-in 10BaseT Ethernet.

Software: Solaris 2.1; SunOS; ONC; OpenWindows, Version 3; DeskSet; OPEN LOOK; SunVision; SunPHIGS; XGL; SunGKS; Xlib; PostScript; Sun Fortran 2.0.1 (\$1,095); switches used: -O4, Sun C 2.0.1 (\$695); switches used: -O4 Graphics library, X11.

In short: Because of the continued slow migration of mainstream office productivity software, the Sun SPARCstation LXs are generally a poor choice for basic business desktop computing, in addition to being mediocre performers at the tasks we tested. You might buy a SPARCstation LX to run engineering and scientific applications, or to perform database functions in a client/server environment. The SPARCstation LX is best suited for use as a PC server or Sun network client.

 ON READER SERVICE CARD

SUITABILITY TO TASK				
Sun SPARCstation LX				
	POOR	FAIR	GOOD	EXCELLENT
Applications development				
Connectivity				
Engineering/scientific/ 2-D CAD				
Desktop publishing				
3-D graphics				
Office productivity				

station LX than you will for all the other platforms we tested combined. CAD programs to look for include Grafpak from Advanced Technology Center, Concept-Station from Aries Technology, CADDs from Computervision, Open Image from JTS Computer Systems Ltd., and Anvil-5000 from Manufacturing and Consulting Services.

High-end relational SQL databases (Adabas, Accell/SQL, Ingres, Oracle, and Sybase) can be found residing on the SPARCstation LX, where they perform much faster than they do on Macs and equally as fast as they do on Pentium-based PCs. You'll also find some expensive high-performance publishing systems (DynaText, FrameMaker, Interleaf 5, and Ventura Publisher), scientific statistical programs such as SAS, and plenty of languages such as Allegro Common Lisp, ObjectWorks/C++, and Saber-C. There is even multimedia software such as Clarity's Rapport for the Sun. What

HOW TO SCREAM & STILL MAKE SENSE

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By freeing up your CPU, the W32 can also help your system perform amazing feats... like displaying realistic, full-motion video.

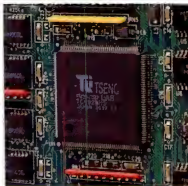
But most importantly, the W32 does it all with DRAM—and gives you performance that leaves many

VRAM-based solutions in the dust: Zippy DOS. Snappy graphics. And the dexterity and flexibility to take on demanding multimedia programs... all based on economical DRAM power.

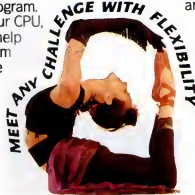
Yet even with all these features, the W32 is still a sensible accelerator that lets you use the comfortable old software

you've grown to love. Because the W32 is completely compatible with the industry standard ET4000 architecture, you can just plug it in and play it.

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CONCLUSIONS

Because of the continued slow migration of mainstream office productivity software, the Sun SPARCstation LX is generally a poor choice for basic business desktop computing. It was also a mediocre performer at the tasks we tested in this roundup. PC folk might buy a SPARCstation LX primarily to run engineering and scientific applications, including CAD and solids modeling, high-end text processing, and relational

The SPARCstation LX

*also makes a good
server, thanks to its
excellent PC
connectivity and
networking tools.*

databases. They might, however, be better advised to spend more money and get better performance from the other Unix workstations tested. High-end graphics applications are a better reason to buy a SPARCstation LX.

You will also discover that SPARCstation LXs (and the related SPARCstations) make good file servers, thanks to their excellent PC connectivity and networking tools. But a Sun workstation, perhaps more than any of the other Unix boxes we tested, requires a serious commitment to its own proprietary Ethernet operating system. This is a commitment that most PC owners are ill-equipped to make.

Although a SPARCstation LX can run some of what you'd consider "mainstream business applications," such as Lotus 1-2-3, Improv, and WordPerfect, you wouldn't want to waste a Sun on such basic business computing tasks. You might, however, run these applications on a SPARCstation LX as an adjunct to its primary purpose. □

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PREVIEW: WINDOWS NT

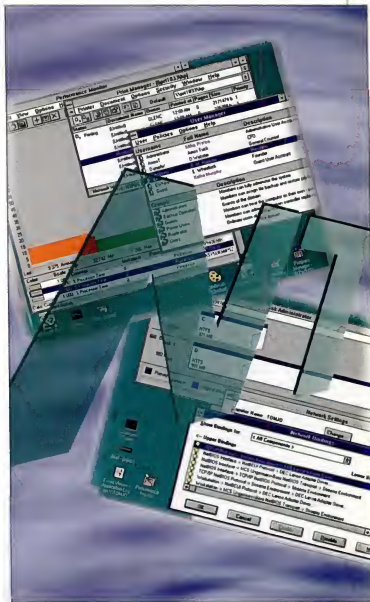
The Power Under the Hood

Windows NT, the first 32-bit Windows, combines the familiar Windows interface with some powerful new under-the-skin architecture.

It looks like Windows 3.1, it acts like Windows 3.1, but it's ever so much more. In fact, it may be more of an operating system than you need. It's Microsoft Windows NT, Version 3.1, and it combines familiar appearances with new features, power, and speed. Windows NT boasts 32-bit operations, built-in networking capabilities, and intrinsic security features—making it a serious contender in business and government environments. Completely reengineered and leaving its DOS roots behind, Windows is a serious challenger for a “next-generation” operating system.

But how does this affect you? Do you need this kind of horsepower? How costly will the time and hardware investment be? How does Windows NT stack up against its 32-bit competitors, Unix and OS/2 2.1? Because Windows NT is such an important and complex product, we're providing an in-depth preview of its features to help you decide whether the time to make your next operating system move is now.

Windows NT provides a variety of new features, be-



by Ben Ezzell

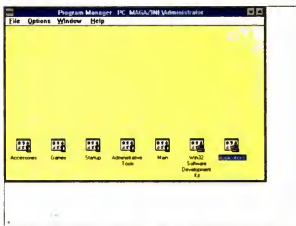
gining with true 32-bit operations and including preemptive multitasking, multithreading, multiprocessor support, operating platform portability, networking, POSIX support, and improved security and data protection. Which features are most important may be determined by your priorities.

THE 32-BIT HURDLE

If speed or the ability to handle large blocks of data lead your wish list, Windows NT's 32-bit capabilities will make a major impression. DOS and Microsoft Windows 3.1 use 16-bit instructions and pass data in 16-bit chunks. Windows NT uses 32-bit instructions and passes data 32 bits at a time, markedly improving performance. Windows 3.1 sits on top of DOS; Windows NT completely replaces the DOS operating system.

A 32-bit operating system achieves its increased performance by removing the memory-addressing bottleneck that has plagued DOS for years. Early 16-bit systems could address memory up to 64K but could not accommodate larger arrays of memory.

To get around the 64K limit, a new addressing scheme that combined a 4-bit segment address with a 16-bit offset produced the so-called segment:offset addressing scheme, which raised address limits from 64K to 1MB. Solutions such as EMS and XMS memory handlers that address high memory beyond 1MB—but only indirectly, through driver utilities—slow operations and are, at



NT's Program Manager shows common and private program groups. Shared groups are noted by the computer icon.

best, only Band-Aids to an inherently limited system.

Windows NT abandons the awkward 20-bit segment:offset scheme and EMS/

HIGHLIGHTS

Microsoft Windows NT

TRUE 32-BIT OPERATIONS Windows NT passes data in 32-bit chunks, directly addressing up to 4GB of RAM—no file swapping, no speed penalties, and no limits on data-segment sizes.

PREEMPTIVE MULTITASKING AND MULTITHREADING An efficient traffic cop, Windows NT juggles system resources among and within applications as needed. Even Windows 3.1 and DOS applications run within a virtual session under Windows NT. With the protected-mode environment, each application executes in an isolated, individual system and cannot access memory beyond its allotment. Multithreading lets an application split tasks into subtasks (threads) for speed and efficiency.

MULTIPROCESSOR SUPPORT Not widely practical yet, this capability will be a boon for multitaskers.

SPEED, WITH SERIOUS RESOURCE DEMANDS Early indications are that Windows NT is fast, but speed and power come at a price. Windows NT needs a minimum 8MB of RAM (16MB is recommended); a 486 ma-

chine is highly recommended, and a full installation requires 70MB.

CROSS-PLATFORM PORTABILITY More efficient than most ports, Windows NT was designed with hardware-independent function layers and deals directly with the hardware platform only in very specific tasks. In addition to PCs, other anticipated platforms include Macs and various high-end workstations. Well-behaved applications that write to the subsystem and system services (not the hardware) can be recompiled and moved across platforms.

BETTER MEMORY AND FILE SYSTEM Windows NT can access more memory more efficiently, thanks to 32-bit operations and the new NTFS (New Technology File System), which handles long file names and nontraditional datatypes. NTFS handles huge storage media and throws in POSIX support and facilities for fault tolerance and file recovery.

INTEGRATED NETWORKING Networking is routinely and easily installed with the rest of the operating system (OS), and operation is virtually transparent.

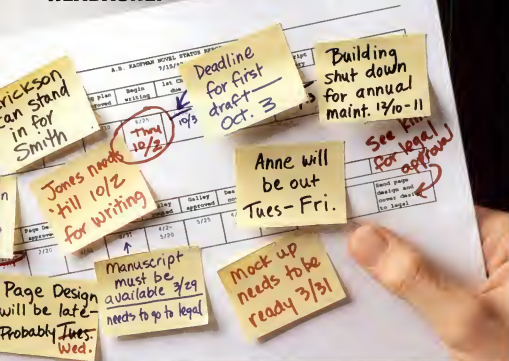
This is what operating system networking should have been like all along.

BUILT-IN SECURITY This is a logical accompaniment to the integrated networking. NT provides a log-on facility even for single-user systems and allows multiple users of the same hardware to customize their interfaces. The OS provides backup functions, fault tolerance, and recovery. To satisfy government customers, it supports POSIX and C2 security levels as well. Windows NT Advanced Server, due out shortly, provides additional features for sophisticated client-server applications.

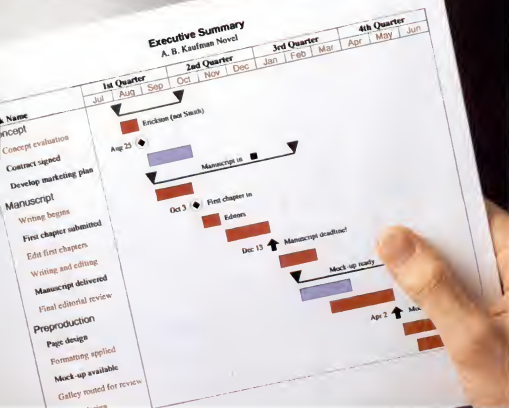
STRUCTURED EXCEPTION HANDLING This makes programmers' lives easier by replacing tedious test processes with simpler structures that flag errors and problematic events.

FAMILIARITY It looks like Windows, it acts like Windows... only it's more powerful. You don't have to learn a new way to work, and (almost) all of your familiar programs work the same as before. You can tailor your interface to your liking, share some applications, and keep others private.

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OPERATING SYSTEMS

Windows NT

XMS drivers in favor of a flat 32-bit memory-address system. It's "flat" because no offset or swapping is necessary; the 32-bit instructions are direct, and can address up to 4 gigabytes (GB) of RAM. Arrays of data can be as large as available memory. You can't even install 4GB on current systems, but such a capability is not unforeseeable.

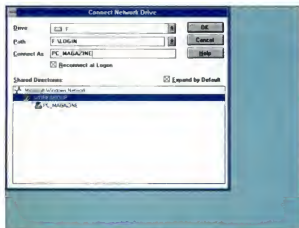
Windows NT is not the first operating system to provide 32-bit operations; Unix and OS/2 version 2.x are based on 32-bit systems. (For more information on these operating systems, see "Unix on Intel: The Beast Turns Beauty" and "OS/2 2.1: IBM's Challenger Revisited") that appear in this issue.

Our Contributors: BEN EZZELL is a Colorado-based free-lance systems analyst and programmer as well as the author of more than a dozen books on computer programming, including the forthcoming *PC Magazine Windows NT Programming*, *PC Magazine Windows NT Graphics Programming* and *PC Magazine User's Guide to Windows NT*.

THE IMPORTANCE OF WIN32

Anyone familiar with Windows 3.1 will feel right at home in the Windows NT environment. The mouse clicks, menus, icons, desktop tools, and accessories are all available. And, Windows NT is backward compatible with existing DOS and Windows 16-bit applications. Conversely, Windows 32-bit apps will run on existing Windows 3.1 systems. The compatibility is handled by multiple subsystems, each residing as a separate process within the Windows NT architecture.

For instance, within Windows NT a virtual memory subsystem, called a VDM or Virtual DOS machine, runs 16-bit Windows (this 16-bit subsystem is referred to as WOW—Windows on Windows) and DOS applications. Windows apps run in a single VDM; DOS apps each get their own VDM. Multiple VDMs can run at once. An OS/2 subsystem can run OS/2 character-based appli-



From the File Manager, you can connect to and disconnect from any networked drive.

cations in single sessions, and a POSIX subsystem runs POSIX-compliant apps.

We found that a few DOS and Windows 3.x applications—such as Micrografx's PhotoFinish, an image editor, and TouchStone Software Corp.'s CheckIt, a test utility, both of which attempt direct disk access—do not execute under NT. Most often, compatibility fails when applications try to control hardware di-

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Easy Installation. PUMA 105 drives have been designed for fast easy installation to the parallel port of virtually any DOS or Windows-based desktop, notebook or laptop system. In addition to the parallel port adapter, the PUMA 105 comes with a printer "pass-thru" to allow simultaneous connection of the drive and a printer to the same parallel port. Just plug the PUMA 105 in, run the easy-to-use Windows-like software, and in seconds you are up-and-running.

Optional Battery Pack. SyDOS offers an optional battery pack which allows up to five hours of use with the PUMA 105, providing maximum portability.

So, whether you are considering an **INTERNAL** or **EXTERNAL** removable disk drive, consider the Marlin 105i or the PUMA 105 by SyDOS, the leader in removable mass storage solutions.

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The NT Development Arena

by Ben Ezzell

Microsoft Windows NT resembles Windows 3.1, but the environment requires a new suite of programming tools. A number of development packages are appearing.

The only fully market-ready Windows NT compiler is Microsoft's Software Development Kit (SDK) for Windows NT. The package consists of a 32-bit version of the Microsoft C/C++ command-line compiler with resource-development editors for the typical lineup of graphical tools: dialog boxes, menus, image resources (cursors, bitmaps, and icons), and a font editor. Microsoft's SDK also provides a porting tool to help convert Windows 3.1 applications to Windows NT, and includes debug facilities and on-line documentation of NT API functions. The SDK supplies compiler versions for both PC and MIPS systems.

Borland International's C/C++ Integrated Development Environment (IDE) compiler and Resource Workshop—a mainstay with many Windows 3.1 developers—are being developed in full 32-bit versions for use with Windows NT. Beta versions of both the IDE and the Resource Workshop function in essentially the same fashion as their 16-bit predecessors. Borland estimates a midsummer shipment of the full 32-bit package.

Windows NT's use of structured exception handling—an architectural provision that simplifies the code designed to respond to abnormal circumstances or errors—is a long-overdue blessing. Exception handling can replace lengthy test processes with simpler structures and responses. Programmers will first notice two keywords, *try* and *except*, which are both new to the Windows NT compilers from Borland and Microsoft. Borland's compilers will supply true C++ exception handling rather than the macro-based exception handling pro-

vided by the Microsoft compiler. Also, the Borland 32-bit compiler offers full template support—an important feature for developers whose previous work is template-based and who want to move the applications to the Windows NT environment with minimal disruption. Borland will also supply a new version of Object Windows Li-

If you are a dedicated Microsoft SDK user, take heart: The new 32-bit tools have not changed markedly from their 16-bit predecessors.

brary (OWL), supporting both 16- and 32-bit systems, for its C/C++ compilers.

Compiler and toolkit improvements and enhancements aside, developing the majority of Windows NT applications is essentially the same as developing Windows 3.1 applications. And conversion from Windows 3.1 to Windows NT is relatively simple.

If you're a dedicated Microsoft SDK user, take heart: The new 32-bit tools have not changed markedly from their 16-bit predecessors, and the 32-bit command-line compiler works almost exactly as in earlier versions. If you prefer Borland's IDE and Resource Workshop, you face a few immediate disruptions until Borland ships its 32-bit implementations. The hassles are minimal, because you can still use the current 16-bit Borland Resource Workshop to develop application resources. One major difference in the 32-Bit Resource Workshop is that it cannot compile application resources as .RES resource files, but instead must create .RC resource scripts.

Borland's 16-bit IDE cannot be used to compile, test, or debug 32-bit Windows NT applications, although the editor features can still be used to write programs. For the moment, you'll need to compile using either Borland's or Microsoft's command-line compilers and use their make facilities to compile and link the application.

Similar to the Borland product, Microsoft's new Visual C/C++ compiler is a 16-bit compiler that can be used as an editor and resource developer even though it cannot directly compile or test 32-bit NT apps.

Both the Microsoft and Borland C/C++ command-line compilers provide code examples and sample applications for Windows NT. For now, compiling and linking developed applications requires either of the compilers and a make file with instructions. But as Windows NT is implemented, fully functional development tools will readily become available.

Thousands of Windows NT applications are in development, including nearly 200 tool/development/compiler packages. Many are already available in prerelease versions. Among the upcoming tools are ported products from current Windows developers and new packages from such familiar companies as Blue Sky Software, DEC, Symantec Corp., Watcom, and Zinc Software.

The MSWIN32 Forum on CompuServe, Library 16, contains a TOOLTX.ZIP file listing Windows NT tools from hundreds of developers. The file is available for downloading in a variety of word processing formats. It uses multicolumn indexes and fills hundreds of pages once printed. It is also available in the Windows NT SDK. Another developers' directory is available directly from Microsoft. You may obtain it by writing for The 32-bit Application Guide, c/o Microsoft Corp. Systems Marketing, One Microsoft Way, Redmond, WA 98052. □



The UPS Service works with a UPS hardware device to warn users of power failures and manage safe system shutdowns.

rectly, such as memory or CPU registers, instead of operating through DOS interrupt calls or Windows 3.x API calls.

To assure that future 32-bit applications will run on existing Windows 3.1 systems, Microsoft developed the Win32s subsystem. Win32s is the 32-bit API that runs on top of Windows NT and operates 32-bit applications. A subset of this API, called Win32s (s is for subset) can run on top of enhanced-mode Windows 3.1. The Win32s subsystem can take an EXE built for Win32 and run it unchanged under Windows 3.1, minus certain Windows NT-specific characteristics such as preemptive multitasking, Bezier curves, and C2 security. In other words, it runs what it can and ignores the rest. VxDs and DLLs necessary to run Win32s will be distributed with 32-bit applications.

MULTITASKED, -THREADED, AND -PROCESSED

True preemptive multitasking is one of the most significant improvements over Windows 3.1. All versions of Windows support an early form of multitasking, which allows more than one application to operate at a time, but previous implementations have been "cooperative" rather than preemptive. Cooperative execution means that an application takes control of both the operating system and the hardware, then (eventually) passes along that control to the next application. This works as long as applications are well-behaved; one application wandering off into some lengthy process of its own can tie up the entire system, however.

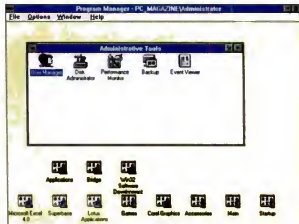
The solution, as implemented by Win-

dows NT, is preemptive multitasking. Much like Unix and OS/2, Windows NT schedules operations among applications, giving each a slice of time with the CPU and system resources. When an application's turn is up, Windows NT suspends the application's operations but saves its status, and restores that status when the application's turn comes again. Individual applications are effectively unaware of the interruptions, but no single application, no matter how badly behaved, can hog the system resources. Also, because Windows NT runs in protected mode, each application gets its own memory area, into which other applications are not able to intrude.

Windows NT also supports multitasking, which lets applications divide tasks into two

or more subtasks. Each subtask gets a separate thread of CPU operations; the threads execute concurrently. Multithreading offers an advantage, even on single CPUs. Writing SQL queries for information from a database (perhaps on a remote machine), for example, utilizes multithreading by executing queries concurrently instead of sequentially.

Out on the cutting edge, Windows NT's support for symmetric multipro-



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The NT Architecture

Microsoft Windows NT has a modular architecture comprised of different subsystems. On center stage is the Win32 subsystem, which provides Windows NT with its user interface and acts as a controller calling the appropriate subsystem for each application. There are subsystems for running OS/2 applications, POSIX-compliant applications, and a VDM (Virtual DOS machine) for running MS-DOS as well as 16-bit Windows applications.

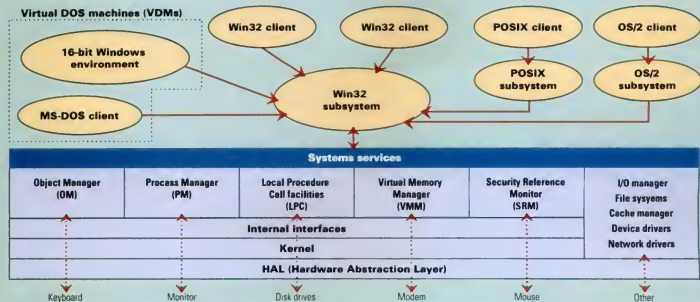
At Windows NT's core, a small kernel provides basic operations: allocating and synchronizing multiple processors, handling interrupts and error exceptions, and scheduling threads. The kernel provides the basic objects and interface routines used by the various levels of the NT Executive, which manages the interface between the kernel and the various subsystems.

The I/O Manager handles device-independent input/output facilities; the File Systems consist of NT drivers that translate file I/O requests into device-specific I/O requests to the FAT, NTFS, HPFS, or network file system. NT treats file systems as device drivers, allowing them to be dynamically loaded. The I/O Manager consists of four principal services: the File Systems, Cache Manager, Device Drivers, and Network Drivers. The Cache Manager buffers file I/O operations using the Virtual Memory Manager's (VMM) paging facility. The device drivers are low-level drivers that handle the actual hardware I/O; the network driver is a system driver that handles network communications requests by transmitting data to and receiving data from the other systems.

Other Systems services include the

OM, which creates and manages NT Executive objects—abstract datatypes, such as an icon's position or a dialog box that represent operating system resources. The PM creates and terminates process threads. The LPC facilities handle messages between client and server processes on the same machine. It is similar to Remote Procedure Call (RPC) facilities used in network client-server processes. The VMM manages memory and protects each memory allocation from encroachment from other processes and applications. The SRM controls file access, guards system resources, and audits access requests.

The HAL, the lowest level of the Windows NT architecture, is system-specific and provides a translation layer between the NT Executive and the physical platform running NT. All NT Executive operations occur by calling functions in the HAL, which respond as appropriate for the platform.—BE



cessing allows an application to run on any free processor in the system or on all processors simultaneously, sharing memory among them. As multiple-CPU machines become more widely and economically available, developers will understand more about harnessing this process. Initially, we can expect Windows NT to run on multiprocessor machines

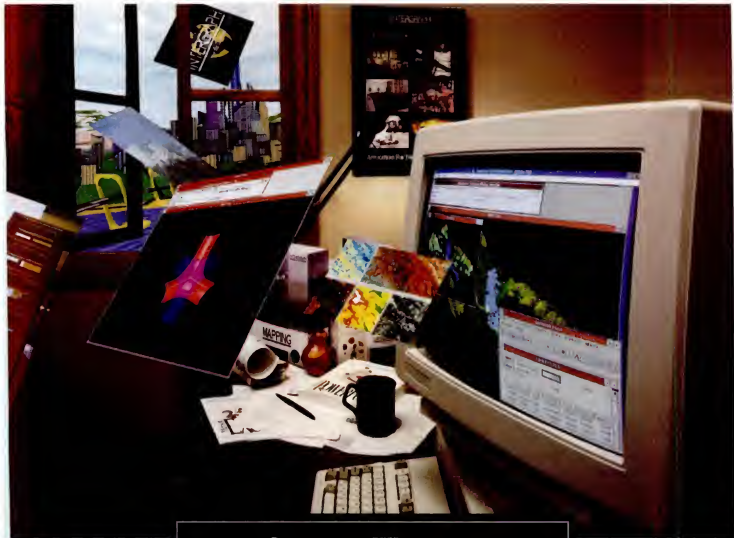
used for file servers and other high-end computing applications. Some versions of the Unix operating system support symmetrical multiprocessing, but OS/2 2.x does not provide this feature.

THE WINDOWS NT GUI

Paradoxically, the Windows NT GUI (graphical user interface) is one feature

that, despite extensive changes and improvements, is virtually indistinguishable from previous versions of Windows—Microsoft has dubbed Windows NT “Version 3.1” to emphasize its similarity to the current Windows release.

The major difference between Windows NT's GUI and the GUI in previous versions of Windows is Windows NT's pro-



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*Paul Maritz, Microsoft
Senior Vice President of Systems*

technical applications can run alongside each other on the same computer. The same friendly Windows environment appears throughout the applications — word processing, spreadsheets, architecture, civil engineering, mapping, and all the rest. CAD users can now spend time designing and drafting, not navigating through the operating system.

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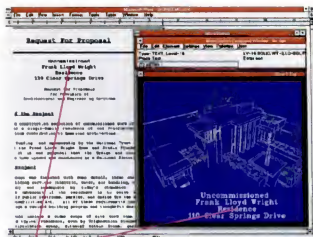
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with your design team and other operations. MicroStation software gives its users this level of proficiency. And keeps them in tune with the best in applications solutions.

Intergraph introduces MicroStation Version 5. It refines a product that is considered the state of the art in CAD graphical user interfaces (GUI). In doing so it boosts CAD to a higher level of usability.

MicroStation Version 5 brings renowned integration advantages to designers and



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engineers who need to run in the Microsoft Windows business environment — Windows, Windows for Workgroups, and Windows NT.

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CAD software should accommodate the way you think, work, learn — even change your mind. You should be able to select a different dimensioning system right in the middle of a command. Or modify a shape and have

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all of the dimensions automatically change. Simple actions — like grabbing a line or object — should be so fast that they require no conscious effort. MicroStation performs functions like these as a matter of course. Other CAD software simply can't.

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Gobbell Hays Partners Inc., a 32-person firm,

uses MicroStation and ModelView from Intergraph to design laboratories for corporations and universities. Says firm president Ronald Gobbell, "Three-dimensional modeling shows the scientist exactly how his lab is going to look." With MicroStation, Gobbell Hays can customize and reuse cells with symbols of equipment, cabinets, and other basic lab features.

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Intergraph's reputation for top-notch customer service follows the company around the globe as international business steadily increases. Intergraph's extensive customer support network

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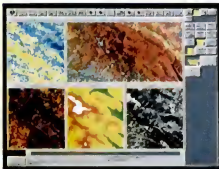
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"I'm a firm believer that they have the best CAD product on the market."

*Daratech Industry Update
November 1992*

Olé OLE

Integrate CAD processing with other Windows applications such as Word and Excel by taking advantage of complete support for Microsoft's Object Linking and Embedding (OLE) technology.



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fundamental for growth in the health care industry, and Limvtec credits Intergraph systems for providing a strong competitive edge.

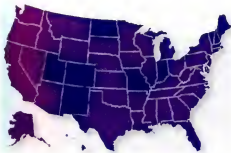
NT

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In 39 of the 50 departments of transportation in the United States, Intergraph applications for surveying, civil engineering, and GIS enable the DOTs to design and maintain the nation's transportation infrastructure.

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MicroStation can give you a foot in the door on major projects around the world. For example, the U.S. Army Corps of Engineers and their subcontractors use MicroStation-based applications. On the massive Hong Kong airport project, Intergraph has been named CAD supplier in the four contracts announced so far. Through numerous contractors and subcontractors, Intergraph applications will play a major role in designing and building the new airport and township, as well as the railway that connects them to Kowloon and Hong Kong.

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Intergraph has traditionally supplied complete software and hardware solutions. In keeping with this tradition, Intergraph offers its own systems designed for Windows NT. They're optimized for CAD immediately out of the box, with full networking capabilities built-in. So it's simply plug-and-play. And with an Intergraph workstation, display clarity, high resolution, and graphics performance make viewing your work a pleasure.

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Feature-packed and available at a low cost, Intergraph's MasterWorks applications for architects and civil engineers bring a new level of power and value to the technical desktop. Intergraph brings to the Windows world functions formerly available only in high-end CAD systems. The MasterWorks series includes these applications:

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Many of Intergraph's customers operate on networks that include a mixture of workstations and PCs, so interoperability is essential. Because Intergraph application file formats are common across hardware platforms, there are no problems of data incompatibility or translation, and sharing data is easy. Also, basic Windows NT includes all the tools needed for TCP/IP communication with our UNIX-based systems, so users can mix UNIX-based and Windows NT-based workstations in their networks and enjoy smooth interoperability.

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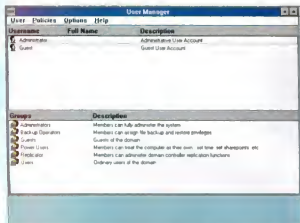
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The User Manager shows a list of user accounts, together with the groups to which each belong. You can drill down for detail.

gram group icons, which appear in two different forms to identify common and private program groups. All users logged onto the system have common program groups. Private program groups may belong to a specific user or to users with access privileges. Only users with system administrator privileges can access the Administration group, for example.

Another, less apparent difference is that any user can tailor the GUI and other specifications of Windows NT.

When a user logs on to Windows NT, the operating environment retrieves his or her personal environmental settings, which include such preferences as color, wallpaper, mouse settings, keyboard (language) drivers, and personal program groups. Multiple settings for a single user are permitted.

One of the more striking differences between Windows NT and other Microsoft operating environments is that the familiar Ctrl-Alt-Del sequence does not reset the system as in DOS, or close an offending application as in Windows 3.1.

In Windows NT, Ctrl-Alt-Del pops up a window and prompts you for your password. This is intended to prevent a Trojan horse virus from trying to intercept your password.

Another Windows NT change concerns the Windows 3.1 Clipboard; in Windows NT, the Clipboard is augmented with a ClipBook, capable of housing multiple images and also capable of being

shared on the network. And of course, OLE (Object Linking and Embedding—still Version 1.0) is fully integrated into Windows NT.

A NETWORKING VIEW

Windows NT and networking are inextricably tied. NT includes basic peer-to-peer network services that support file copying, e-mail, and device sharing. In addition, Windows NT can establish connections with existing network systems such as Banyan's VINES, Novell's NetWare, Sun NFS, and Microsoft Windows for Workgroups.

In keeping with the modular organization, network services run in a protected subsystem within the NT environment. NT includes a variety of APIs that allow you to connect, transfer data, and browse across the network. APIs include: NetBIOS (providing backward compatibility with DOS, Win16, and OS/2, as well as a new 32-bit NetBIOS), Sockets (a Unix-style interface), Win32 I/O (for remote machines) and Win32 network (to browse NT network resources). Win32's named pipe and mailslot API expedites LAN connections and broadcast mes-

The Microsoft Family of Operating Systems

Microsoft offers five different operating environments. Even though the Windows environments look similar, the evolution from Windows 3.1 to Windows NT Advanced Server involves some fundamental shifts.

	MS-DOS	Microsoft Windows 3.1	Microsoft Windows for Workgroups	Microsoft Windows NT	Microsoft Windows NT Advanced Server
User interface	Character-based	Graphics windows	Graphics windows	Graphics windows	Graphics windows
File system	FAT	FAT	FAT	FAT or NTFS	FAT or NTFS
Address space	16-bit segmented	16-bit segmented or 32-bit flat (using Win32s)	16-bit segmented or 32-bit flat (using Win32s)	32-bit flat	32-bit flat
Multitasking model	None	Cooperative	Cooperative	Preemptive	Preemptive
Network support	None	Drivers for popular NOSs	Peer-to-peer	Integrated file and print sharing, named pipes, RPC, industry-standard transports	Same as NT, plus remote-access Macintosh clients, single log-on to enterprise for all clients
Hardware platform	Intel 8088 or better	Intel 286 or better	Intel 286 or better	Intel 386 or better, DEC Alpha, MIPS R4000	Intel 386 or better, DEC Alpha, MIPS R4000
Multimedia	None	MCI, MIDI, sound	MCI, MIDI, sound	MCI, MIDI, sound	MCI, MIDI, sound
Security	None	None	Share-level	C2-level, maintained per system	C2-level, maintained per enterprise
Multiprocessor support	None	None	None	Symmetric	Symmetric
Fault tolerance	None	None	None	Transaction-based file system with NTFS and UPS support, tape backup	Same as NT, plus disk striping, with parity (RAID), drive duplexing, disk mirroring

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magine getting this kind of thrill from a PC.

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- 512 KB VRAM, expandable to 1 MB
- 127 MB IDE hard drive
- 3.5" 1.44 MB floppy disk drive
- 3 available full ISA slots
- 14" SVGA low emission non-interlaced color monitor
- MS-DOS® 6.0 and Microsoft Windows™ 3.1 installed
- 2-button mouse
- 101-key keyboard
- Low-profile enclosure (3.5" x 16.1" x 15.6")

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- 512 KB VRAM, expandable to 1 MB
- 127 MB IDE hard drive
- 3.5" 1.44 MB floppy disk drive
- 3 available front accessible 5.25" drive bays
- 0 available full ISA slots
- 14" SVGA low emission non-interlaced color monitor
- MS-DOS 6.0 and Microsoft Windows 3.1 installed
- 3-button mouse
- 101-key keyboard
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- Snap-on trackball
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- 80-key keyboard

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DECpc 325SLC

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DECpc 425SLC

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and attachments as large as 32K. Schedule+ relies on the mail app to send and receive, but lets users maintain private and public or shared schedules.

Emphasis on security features naturally follows from Windows NT's focus on networking. Windows NT includes Class2- (C2) level government security standards. This is a huge step up from DOS, but the C2 level is not as secure as some of the Unix security features, which include B1 standards. Windows NT is currently involved in the formal government certification process, which is mostly of note to users in government. Windows NT implements security and access-tracking on a per-process rather than per-record basis, and checks for rights only when a user seeks file access.

ADMINISTRATIVE CLOUT

Many of the network features require administrative privileges. New administra-

tive tools include the User Manager, a tool that helps manage the creation, maintenance, and security of user accounts by providing an overview of both user-account status and user groupings on the NT workstation; the Disk Administrator, a graphical equivalent of FDISK for partitioning, creating, deleting, and managing volumes; and the Performance Monitor, a graphical tool that charts the activity of system components in use. (End users also have access to this.)

The Backup facilities emphasize network backup. Full support for tape devices, and such optimizing features as a quick erase for tapes and a retention command to eliminate loose spots on tapes are available. The Event Viewer provides constant status on specified events.



The Control Panel has some new additions to help with the Windows NT setup, including networking connections.

NT Tips

CONTINUED

many popular network cards, and more drivers are shipping soon. A hardware compatibility check is advisable (see next tip), however. Windows NT automatically detects network adapter cards, recognizing the card type, interrupt assignments, and other characteristics. And network printer access is easy because the network automatically recognizes the printers installed on the various nodes in the system.

Video and Tape Drivers Late beta versions of Windows NT offered limited support for high-resolution video cards and high-color resolutions. The default VGA video driver supports all video cards, and Microsoft is developing and distributing higher-resolution drivers; for now, users should carefully check video card compatibility before switching to Windows NT. The same holds true for tape backup systems. Reference lists of the latest hardware and software compatibilities are available on-line on CompuServe's MSWIN32 Forum (GO MSWIN32) Library 1, or on the MSWIN32 Forum, Library 17.

VESA Local-Bus Boards In informal testing, we found that running a VESA-standard local-bus motherboard with a compatible local-bus video card produced video speeds approximately 15 percent faster than conventional video operations. Problems surfaced, not in video performance but with failure of the NTVDM.EXE (NT Virtual Device Memory) utility. This caused failures in both the Windows 3.1 subsystem and the DOS shell. Identical failures occurred with three local-bus video cards from different manufacturers. The local-bus motherboard operated correctly only with a conventional 16-bit video card. The problem seems to be linked to certain local-bus boards and is not characteristic of VESA motherboards in general.

Emergency Repairs Doing things like trying to install a video driver that is incompatible with your graphics display card can cause serious problems—Windows NT may not appear when booted. During installation, create an Emergency Repair Disk that can recreate your NT system without losing the bulk of your information. First boot the NT installation disk; insert the Re-

NTFS: DON'T DROP THE FAT

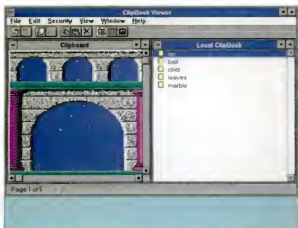
Replacing the DOS FAT (file allocation table) system is a higher-performance system called NTFS (New Technology File System). NTFS won't be evident when you boot up Windows NT, but its

pair Disk when prompted—the system should be restored without big losses.

Other driver/adaptor limitations Any peripheral hardware that needs custom drivers is potentially incompatible until new 32-bit drivers are available. You cannot expect existing 16-bit OEM drivers to work under Windows NT's 32-bit environment. Items to check for compatibility include sound and MIDI cards (only some are supported); printers (most are supported); CD-ROM devices (check for SCSI card compatibility with supported drivers); and non-standard mouse or pointing devices (some older mice are not supported). If your NT-incompatible CD-ROM/SCSI runs under DOS, you can still use it for installation even though it may not operate once NT is loaded. Other potential conflicts include fax cards, voice-recognition cards, camera interface cards, remote device control cards, and other specialty peripherals; most modems are accommodated.

Introducing Windows NT Windows NT's tutorial provides step-by-step instructions and illustrations for network operations. It's worth a close look.

Windows NT



The ClipBook Viewer includes the familiar Clipboard, as well as the Local ClipBook, which can be used to share data.

advantages will become apparent. For example, file and directory names can have as many as 256 characters. (The program automatically creates and stores a DOS name to ensure DOS compatibility.)

NTFS is the reason for many of the advantages of NT, such as fault tolerance, security, support for huge files, POSIX compliance, faster disk access, and support for file names of unlimited size and Unicode (international) style.

Windows NT can read and write files to the 16-bit FAT used by DOS and Windows, or to the new 32-bit NTFS. The two file systems cannot mix, however; an entire drive or partition must be formatted for use with NTFS files in order to take advantage of the new file structure. A potential disadvantage is that DOS/Windows 3.1 cannot access a NTFS volume.

Floppy drives also support only FAT files, causing at least one measure of incompatibility between DOS/Windows 3.1 and Windows NT NTFS.

At least until more Windows NT drivers for peripherals ship, the new file system complicates backup operations. Few tape drives yet support NTFS, so users may need to back up data from a hard disk partition still set up under FAT. Similarly, file-compression utilities are not yet compatible with Windows NT because they do not support the

32-bit operations. This limitation includes the DOS 6.0 file-compression utility in its initial release.

So while you can choose either to upgrade fully to Windows NT or to use the Boot Loader in Windows NT to load your choice of operating systems (at this time only NTFS and DOS are supported), we recommend the latter course. Windows NT's Boot Loader works similarly to the boot loader found in OS/2. Remember, however, that dual-boot DOS must boot from the C: partition, which must remain a FAT, not an NTFS, drive. When you use the boot loader, however, Windows NT can boot from any partition. Windows NT offers a choice of drive/partition for installation, asking you whether you want to keep the installation partition as a FAT drive or convert to the NTFS

file system. If you select conversion to NTFS, the program preserves all of the existing files. Also, regardless of which file system is used, both NTFS and FAT drives are fully accessible from within Windows NT.

As with Windows 3.1, Windows NT's Cache Manager reads ahead on the hard disk during data retrieval. It holds the extra data in memory in order to respond to the next retrieval request. In like fashion, a disk-write operation writes the data rapidly to the cache memory and then transfers it to the disk later as time permits. (The Print Manager is similar in operation but uses RAM, not cache memory.) The drawback, of course, is that data in cache memory is lost if the system is reset or if power is lost. One improvement is that NT's Cache Manager does some automatic balancing.

PORTABLE AND SCALABLE

The major difference between Windows NT's architecture and that of its predecessors is its modular design (for more information, see "The NT Architecture"). Among the most publicized (and controversial) features of Windows NT is its portability. The initial release runs not only on PCs, but also on RISC systems such as Digital's Alpha AXP, and the MIPS R4000 (for more information, see "Workstation Platforms: Heavyweight Contenders" in this issue). To achieve this portability, Microsoft designed the operating system in levels. To port the

Operating System Highlights

Thirty-two-bit operating systems are more alike than different. We chart the key variables here. For more detail on the specifications for the various Unixes and OS/2 2.1, see the stories "Unix on Intel: The Beast Turns Beauty" and "IBM's Challenge Revisited" in this issue.

	Microsoft Windows 3.1	Microsoft Windows NT	OS/2 2.1	Unix
Multitasking model	Cooperative	Preemptive	Preemptive	Preemptive
Multituser capability	No	Yes (via client server)	No	Yes
Kernel	DOS, KERNEL.EXE (protect mode)	NT Executive	OS/2 kernel	Mixed (Mach, SVR3.2, SVR4.2)
File system	FAT	FAT, HPFS, NTFS	FAT, HPFS	HPFS, SS, UFS
Symmetric multiprocessor support	No	Yes	No	Yes (NeXT, SCO, Solaris)
Security	No	Yes (C2 level)	No	Yes (B1, B2/C2 level available as modules or built-in)
Networking	No	Yes (peer and server)	Yes (server)	Yes (peer and server)
Maximum addressable memory	32MB with extended memory	4GB	512MB	4GB
Maximum theoretical file size	4GB	17 billion GB	64GB	2GB
Runs Windows 3.1 applications	Yes	Yes	Yes	No
Hardware platforms	Intel 286 or better	Intel 386 or better, DEC Alpha, MIPS	Intel 386 or better	Intel 286 or better, DEC Alpha, MIPS, Motorola 680x0, PowerPC, RISC, SPARC
Disk space required for full installation	10MB	70MB	35MB	100MB (typical installation)



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Application SW	Y	N	Y	Y	N
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system to different platforms, they had to refine only the sections that interact directly with the hardware to accomplish specific tasks. Within the NT Executive—the Windows NT operating system—only the hardware abstraction layer (HAL) and portions of the kernel and memory manager are platform-specific. The remainder of the Windows NT system is independent of the physical platform. Operating systems that are derivatives of the Mach kernel, such as NeXTStep and the “still-in-the-planning-stages,” future release of OS/2 use a similar hardware-independent approach.

System transportability is only part of the Windows NT cross-platform story. Equally important is its ability to move software between systems—for example, to create applications that run under Windows NT regardless of the hardware platform.

Transporting applications among systems with different CPUs typically requires tremendous effort. In effect, programmers must rewrite and recode to match the platform hardware. Under Windows NT, developers still must recompile applications to match the platform of execution. But if they developers follow Windows NT's enforced restrictions to remain hardware-independent, they need only recompile the code with a compiler that is appropriate to the target system.

Less attention has been paid to scalability, so many portable and notebook PCs will find Windows NT too big a system to swallow. Nothing inherent in Windows NT prevents it from being installed and run on a portable or notebook system, but the hard disk storage and memory requirements are great.

One alternative we expect many users to adopt is to install Windows 3.1 on a

portable and use the Win32s subsystem to execute 32-bit applications under 16-bit Windows 3.1. You'll see some minor performance loss due to translation and 16-bit OS operating characteristics, but the tradeoff is disk space. The bottom line, however, is that Windows NT programs will run on Windows 3.1 just as Windows 3.1 applications run under Windows NT.

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Requirements: 80386-/80486-based PC, 8MB of RAM (12MB recommended, 16MB recommended for SDK).

In short: Our preview of Microsoft's new Windows-based operating system shows a totally rearchitected, 32-bit OS that will continue to support both Windows 3.1 and DOS applications. Features include a flat memory, fast 32-bit operations, built-in networking, and C2-level security. This release runs on PCs as well as Digital's Alpha AXP, and MIPS R4000 systems.



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TOLERANT TO A FAULT

At the systems level, the Windows NT kernel provides fault-tolerance functions, which internally handle many errors that could otherwise terminate an application or even crash the system. These exception handlers are platform-specific, but essentially Microsoft takes the exception handling in Windows 3.1 to a higher level (for more information, see "The NT Development Arena.")

More important for data-critical systems are the hard disk fault-tolerance mechanisms. These appear in more full-bodied implementations in NT Advanced Server, but make an initial appearance in Windows NT. For example, NT has disk striping, in which partitions and files are shared across several physical drives; striping boosts performance. Advanced Server has disk striping with parity, in which stored parity information

built-in tape backup operations and UPS connections that let Windows NT monitor operations and prepare for shutdown. Neither function alone is a reason to switch to Windows NT, but each may be considered a pleasant bonus.

A PERFORMER

Windows NT demands hefty hardware for its advanced operations. The system

requires at least an 80386 or 486 CPU, and cannot be installed on a 286-based computer. Microsoft recommends at least 16MB of RAM, although NT can run in 8MB. Part of the payoff is NT's ability to use 32-bit addressing to directly address up to 4GB of RAM. Because it runs in protected mode, Windows NT allocates application memory in small segments as needed, and protects each appli-

**Microsoft Windows NT
demands hefty hardware—
at least an 80386 CPU—
for its advanced operations.**

permits re-creation of data if one of the drive units is lost.

Other new features include Unicode—also known as "wide characters"—a system that represents characters as 16-bit values instead of traditional 8-bit character codes. Unicode is an important feature for the international market. It allows an alphabet that, instead of the traditional 256 characters, is a set of 65,536 characters—enough to represent most of the world's major alphabets plus symbol sets. In addition to being 16-bit, Unicode also separates the "essence" of the character from the font or format.

Windows NT's POSIX subsystem can accept POSIX-compliant applications. These may require such features as hard links, case-sensitive file names, and file-access time data. While most users do not require POSIX compliance, many government agencies use this standard, and its inclusion in Windows NT broadens the system's scope.

Other Windows NT features include

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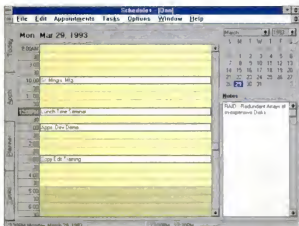
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The Scheduler includes an appointment calendar, planner, note pad, and task list. It can schedule appointments via the network.

caction's memory from access by other applications. When available memory is insufficient, NT uses virtual memory (the hard disk), swapping application code in and out of active memory.

Hard disk access can be a bottleneck; hard disk storage requirements are hefty. NT requires 30MB of free hard disk space to install system files, plus space for swap files; in all, 70MB of storage space is required. NT supports files as large as 1.8×10^{19} bytes (1.8×10^{10} GB).

Performance is difficult to gauge, in part because final code was not yet available as we went to press, in part because there are no 32-bit NT applications yet, and in part because benchmark-testing utilities do not compare operating systems as much as they evaluate CPUs and hardware platforms. As we went to press, we were in the last phases of development in compiling benchmark tests specifically for NT operations. But for now, since both Windows 3.1 and Windows NT execute DOS and 16-bit Windows applications, we ran some DOS- and 16-bit Windows-based performance tests. Microsoft still has some work to do to improve NT's performance. The company has acknowledged problems that we discovered—problems with floating-point calculations and with printing speeds. Fixes have already been made and will be available in the shipping version of the product.

We ran our Windows NT tests on a Compaq Deskpro M, a 486/33 with 16MB of RAM and a 330MB hard disk. First, we tested WordPerfect 5.2 running alternately under DOS 5.0, the March beta

version of OS/2 2.1, and the beta version of Windows NT. Tests included search-and-replace, spell-check, and print-to-file operations. We also ran both Ami Pro and Microsoft Excel under Windows 3.1, OS/2 2.1, and Windows NT. We timed the execution of Ami Pro and Excel macros that automate normal spreadsheet and word processing activities. With WordPerfect, Ami Pro, and Excel, DOS or Windows always performed better than OS/2 or NT. OS/2 always outperformed NT. Sometimes NT

was a little slower; sometimes it was quite a bit slower.

For example, when we used WordPerfect, Print to File took 12.70 seconds under DOS. The same task took 13.19 seconds under OS/2 2.1 and a full 17.74 seconds under Windows NT. Even more pronounced were the differences we found when using Ami Pro in a series of procedures that included printing to a file: Under Windows 3.1, Ami Pro took 65.8 seconds; it took 85.25 seconds under OS/2 2.1, and a full 160.61 seconds under Windows NT.

THE VIEW FROM MANY WINDOWS

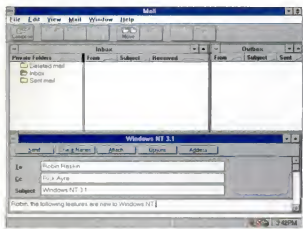
At least as of this writing, Microsoft is not espousing an "NT for all" solution. Instead, the company has been evangelizing the Windows Everywhere strategy—a family of Windows systems. Each family member is aimed at a specific group of systems or platforms but can also cooperate with and complement other members.

At present, the Windows family consists of three principal products: the popular Windows 3.1, the recently released Windows for Workgroups, and Windows NT as the newest member. Windows NT Advanced Server is expected to ship shortly after the NT release. Microsoft will continue to upgrade and support Windows 3.1—with the next version focusing on a more object-oriented architecture. Windows for Workgroups brings Windows 3.1 users peer-to-peer networking capabilities for PCs, as

well as client/server connections to other networks and servers. (For more information, see "Groupware: Are We Ready?" in this issue.)

Windows NT, still a desktop product, adds the client/server component to the peer-to-peer services, and it introduces a 32-bit version of Windows. NT's most significant differences are not in operating format, style, or appearance, but the change from a 16-bit shell running under DOS to a true 32-bit standalone operating system, and that system's portability—which lets it run on a variety of hardware platforms. Windows NT Advanced Server, which will incorporate Microsoft LAN Manager, will extend the Windows NT operating system specifically to operate network servers.

Although Windows NT does not replace existing Windows 3.1 systems or make them obsolete, the new operating system offers many advances over earlier versions of Windows as well as over earlier operating systems. Because of these advances, many users with 80386/486 systems—and, of course, users of the upcoming Pentium (586) system—will find immediate advantages in moving to Windows NT.



The Mail facility tracks incoming and outgoing mail, including deleted mail, in case you change your mind about discards.

But should you buy? In all probability, Windows NT will claim about 15 percent of the current Windows market in the near future—the 15 percent who need high-end business-environment features such as security and fault tolerance. Others might be well served by waiting for the release of Windows 4.0, which should include a fair amount of capability of its own. □



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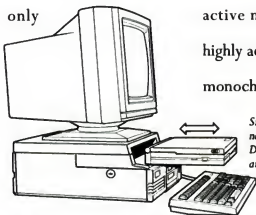
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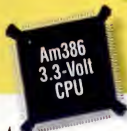
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PREVIEW: OS/2 2.1

IBM's 32-Bit Challenger Revisited

With Microsoft's Windows NT and a number of GUI-based Unix systems on the brink of release, the battle for the hearts and minds of PC power users is under way.

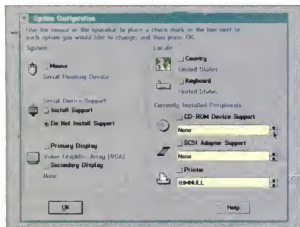
by Joe Salemi

Almost a year after our preview of OS/2 2.0, we have taken a look at a beta version of the upgrade, OS/2 2.1. The changes from the last version are mostly incremental, but they go a long way toward overcoming the obstacles to wider acceptance of IBM's 32-bit operating system. Version 2.1 includes Windows 3.1 compatibility (Enhanced mode), multimedia support, better control over DOS and WIN-OS/2 sessions, and support for a broader range of peripherals. OS/2 was a front-runner in the 32-bit operating system derby. (New players have since appeared from Microsoft and Unixware. See "Windows NT: The Power Under the Hood" and "Unix on Intel: The Beast Turns Beauty" in this issue.) This revision keeps it very much in the competition.

A RECAP OF OS/2 2.0

While OS/2 2.0 was touted as the first 32-bit operating system designed entirely for Intel-based PCs, the initial release was actually a mixture of 16-bit and 32-bit modules. The operating system kernel and file system support were 32-





OS/2 2.1's Selective Installation screen adds many more options for configuring on the fly.

bit, but the Presentation Manager GUI and the Workplace Shell (the primary user interface) were still 16-bit programs. Version 2.0 also maintained support for both the DOS-based file allocation table (FAT) file system and the High Performance File System (HPFS) introduced in OS/2 1.2.

Built-in support for multiple DOS and Windows 3.0 sessions—running either full-screen or as windows on the Workplace Shell desktop—was new in Version 2.0. Each DOS session supported all the features of DOS 5.0, including the Lotus/Intel/Microsoft expanded memory specification, extended memory specification, and DOS protected-mode interface memory. You could even load DOS TSRs into the upper memory block area. Users found they could have at least 640K of RAM available in each DOS session and raise available memory to well above 700K, depending on the DOS settings and the needs of the application.

Windows 3.0 support let users run their Windows applications as part of a single full-screen WIN-OS/2 session or as a single application running in a window on the Workplace Shell desktop. Version 2.0 also provided Dynamic Data Exchange (DDE) and common Clipboard support between Windows applications or between Windows and OS/2 applications.

But last year's release had its share of problems. Adding a new printer to the system was often an exercise in frustration, and the process wasn't at all logical. Users had to work through a couple of settings screens to find the option for adding a printer driver. The release also

lacked support for a lot of small computer system interface (SCSI) devices, particularly CD-ROMs; only IBM and Toshiba drives were supported. It also had only limited support for Super VGA (SVGA) cards. The GUI interface, still a 16-bit product, was sluggish, and the few applications written specifically for Windows 3.1 didn't run on OS/2 2.0.

IBM has addressed some of these problems by releasing new or updated system files and drivers through various on-line services, including the company's support forums on CompuServe (see the sidebar "Supporting OS/2: IBM Shatters Tradition") and its own National Service Center BBS (404-835-6600). Late last year, IBM released a ServicePak that included all the fixes and new drivers to date, 32-bit graphics support, and additional SVGA drivers. A combination of 2.0 and the ServicePak (also known as Corrective Service Diskettes or CSDs, in IBMpeak) is now preinstalled on some IBM PS/2s.

WINDOWS 3.1 AND MULTIMEDIA SUPPORT

IBM said that the version provided for this article was the final beta of the long-

awaited OS/2 2.1, but would not provide a firm release date for the final version. A Spring Comdex release or announcement is likely.

The most important enhancement in 2.1 is the addition of full Windows 3.1 compatibility. The Program Manager, which appears as a folder on the desktop, opens in a window rather than in a full-screen session as it did in Version 2.0 (a full-screen Windows session is also still available). You can configure the Program Manager to run multiple Windows sessions. Version 2.1's WIN-OS/2 session looks identical to Windows 3.1. The Windows 3.1 support includes OLE (only between Windows programs), TrueType, and multimedia capabilities.

A number of additional Windows accessories are included in this release. While 2.0 only provided the Clock and Clipboard accessories, 2.1 adds the Notepad, the OLE utility, the File Manager, Windows Write, the Character Mapping utility, and the Media Player. The System Setup and Control Panel are identical to Windows 3.1, though the Setup utility is only used to establish the type of network connection in WIN-OS/2 sessions.

Three new settings in the WIN-OS/2 settings notebook govern the Windows 3.1 sessions. The first, and the most

HIGHLIGHTS

OS/2 2.1

WINDOWS 3.1 SUPPORT: OS/2 2.1 supports Windows 3.1, including multimedia and OLE applications. WIN-OS/2 can be run in Standard or Enhanced mode, which lets you use 32-bit Windows 3.1 applications.

MULTIMEDIA SUPPORT: OS/2 2.1 has the Multimedia Presentation Manager/2 tools that are currently available as add-ons for 2.0.

SVGA: OS/2 2.1 supports many popular SVGA cards in both Presentation Manager and WIN-OS/2 sessions; higher-resolution screens and 256 colors are available.

SCSI SUPPORT: Drivers for Adaptec,

DPT, Future Domain, and IBM SCSI cards, along with a generic driver supporting most SCSI adapters (except CD-ROM drives) are included with Version 2.1.

CD-ROM SUPPORT: OS/2 2.1 provides drivers for more than 30 different CD-ROM drives.

32-BIT GRAPHICS: Version 2.1 includes the 32-bit graphics engine introduced in the 2.0 ServicePak.

CONFIGURABLE START-UP FILES: OS/2 2.1 lets you specify or customize a start-up file other than AUTO-EXEC.BAT for each DOS and WIN-OS/2 session.

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The WinPro 486 is an ultra-fast PC workstation. It features a Cytrix 486SLC/25MHz processor with 2 MB RAM and 1 MB internal cache. It comes complete with a 3.5" high-density floppy drive (5.25" floppy drive optional), 167 MB hard drive, a Super VGA video controller (monitor not included), 5 expansion slots, one parallel and two serial ports, full 101-key extended keyboard, and a mouse. The software you want is already installed. You'll get MS-DOS, Windows 3.1, Works for Windows, and Virscan. Call MicroWarehouse and let us help you choose the right Monitor to complete your WinPro system. Manufacturer: Leading Edge CP0470

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Version 2.1 includes full support for Windows 3.1. This is the Windows 3.1 Program Manager running in a window.

important, sets Windows to run in either Standard or Enhanced operating mode. Improved Windows 3.1 compatibility lets you run 32-bit Windows applications. The other two WIN-OS/2 settings control whether the DDE capabilities and Clipboard are private to WIN-OS/2 sessions or can be used to share data with OS/2 applications. If you don't need to share these capabilities with OS/2, you can make a bit more RAM available for your Windows applications by disabling these settings.

A WIN-OS/2 settings icon in the System Setup folder lets you set global defaults for Windows applications that you run directly from the desktop; programs run from the Program Manager or full-screen WIN-OS/2 sessions inherit the global WIN-OS/2 settings established for those sessions. You can still manually adjust the setting for each application that has an icon on the desktop if the defaults aren't appropriate.

The Migrate Applications utility in the System Setup folder gives you an easy way to add Windows applications to your OS/2 desktop, even if they're already defined in the Program Manager.

The Windows 3.1 multimedia capabilities work in conjunction with OS/2's Multimedia Presentation Manager/2 (MMPM/2), currently available as a 2.0 add-on but included in 2.1. It supports the IBM M-Audio card, the Creative Labs' Sound Blaster series of sound cards, and the Media Vision Pro AudioSpectrum 16 card and allows playback of audio and multimedia CDs with a supported CD-ROM drive.

If you choose to install MMPM/2, the Sound Setup utility now lets you assign sounds from .WAV files to specific events. A volume control and folder with multimedia utilities is also added to the desktop. A new option that lets you control if and when DOS and WIN-OS/2 sessions can access the audio card has been added. Special WIN-OS/2 drivers let you use the sound card in Windows sessions as well, with the same support for playing .WAV files or adding them to system events found in Win-

dows 3.1.

OS/2 2.1 includes built-in support for both the Adobe Type Manager (ATM), which was present in 2.0, and TrueType in WIN-OS/2 sessions. The built-in ATM has been updated to Version 2.5. TrueType fonts are not included, but they can be added with new Windows applications or through the Fonts icon in the WIN-OS/2 Control Panel.

Version 2.1's Windows 3.1 support is likely to be the last upgrade to OS/2. IBM's cross-licensing agreement with Microsoft expired in September 1992, and because of the often-public rivalry between the companies, the agreement has not been renewed. No one can say what incompatibilities may crop up when Microsoft releases Windows 4.0 or the 32-bit version that is reported to be in development.

OTHER IMPROVEMENTS

A new option in the settings notebook called DOS_AUTOEXEC lets you specify a start-up file other than the default AUTOEXEC.BAT so you can completely customize all sessions. The settings notebook itself looks much cleaner and much more like a spiral-bound notebook (see photo).

A FAX/PM applet to send and receive faxes is new to the Productivity folder. It works with any Class 1 fax device, such as a fax card or modem.

The installation process for the new version is very smooth and seems to need less time than it did under 2.0. A new version of the Selective Install program, which eases both system reconfiguration

and the addition of peripherals, is included. New checklists let you add a CD-ROM, SCSI adapter, or new printer at any time.

Version 2.1 includes support for SCSI adapters, including the leading models from Adaptec, AHA, Distributed Processing Technology (DPT), Future Domain, TMC and, of course, IBM's own PS/2 SCSI adapters.

The generic SCSI driver IBM introduced after the release of 2.0 is also included in 2.1, though it doesn't support CD-ROM drives. Support is provided for CD-ROM drives from DRM, Hitachi,



FACT FILE

OS/2 2.1 beta

IBM Corp., Old Orchard Rd., Armonk, NY
10504; 800-426-2468, 914-765-1900

List price: \$195 when released, upgrade price from previous versions not yet announced.

Requires: 386SX or better, 4MB RAM (8MB recommended), 60MB hard disk space, graphics card, and monitor (VGA or better recommended).

In short: IBM's OS/2 Version 2.1 has full Windows 3.1 capabilities, including OLE, TrueType, and multimedia, and it also has increased levels of support for Super VGA, SCSI, and CD-ROM devices. The package also includes the OS/2 Multimedia Presentation Manager/2 (MMPM/2) modules. Many minor improvements make the configuration of DOS and WIN-OS/2 sessions easier. Overall, the changes in 2.1 make OS/2 more capable of running your existing applications and new applications.

ON READER SERVICE CARD

NEC, Panasonic, Pioneer, Sony, Texel, and Toshiba. Many vendors of unsupported CD-ROM drives are working on OS/2.2.x drivers.

OS/2 2.1 also has far better support for SVGA systems. Higher-resolution screens (for instance, 800-by-600 and 256 colors are available. The beta we

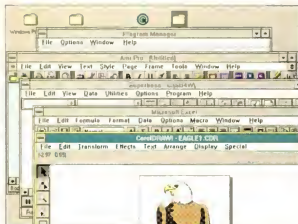
looked at includes drivers for SVGA cards that use the following chip sets: ATI Technologies: ATI 28800
Cirrus Logic: CL-GD5422, CL-GD5424
Headland Technology: HT209
IBM: VGA256C

Trident Microsystems: TVGA 8900C
Tseng Laboratories: ET4000
Western Digital Imaging: WD90C11, C30, and C31 in C30 mode.

Other enhancements include support for the Advanced Power Management specification, which lets the operating system control battery consumption on portable computers, and drivers for PCMCIA devices. Drivers for a number of printers are also supported. The new default system font is also slightly larger and bolder than the one in 2.0, which makes the menu items and icon titles a bit easier to read. Instructions are available to reset the default to that of 2.0.

SYSTEM REQUIREMENTS

System requirements for OS/2 2.1 are almost identical to those of Version 2.0: a 386SX-based PC or better is required, with a minimum of 4MB RAM. The operating system itself takes up 3MB to 5MB more disk space than the Version 2.0, depending on the options you choose to install; about 35MB for a full installation. Most of the additional disk space is used by the files that provide Windows 3.1 compatibility. As in the earlier version of OS/2, we recommend you have at least 8MB of RAM to avoid system slowdowns from constant swaps to the hard drive. Even though OS/2 runs on 386SX and DX systems, you'd be better off using at least a 486SX.



The update also features improved support for Windows 3.1 applications, including higher-resolution screen modes.

The beta version we obtained came on 25 3.5-inch disks, including two disks of display drivers and four of printer drivers. The MMPM/2 files come on three 3.5-inch disks. IBM has also been distrib-

■ Supporting OS/2: IBM Shatters Tradition

by Joe Salemi

Toll-free support numbers? On-line forums? Electronic bulletin boards? What happened to the IBM that used to send you to your certified IBM dealer for help?

These days, if you're having a problem with OS/2 Version 2.0, you can call IBM's own support line, which is listed in the manuals (1-800-237-5511), to register. Alternatively, if you're a member of the ZiffNet on-line service, you can jump across the gateway to CompuServe and get help there with OS/2 problems in one of several IBM forums. And if you're not on CompuServe or ZiffNet, you can call IBM's BBS in Atlanta to get help.

In trying to ensure that a product as complex as OS/2 would be successful in the marketplace, IBM decided that it had to make sure that users had access to the best support possible. And that decision meant that IBM itself had to provide the help. The company's unusual support effort began even before the release of Version 2.0 with the establishment of the IBMOS2 forum on CompuServe last April. The forum served OS/2 users as a source of

information, support, bug-fix files, and, eventually, full copies of the Corrective Service Diskettes (CSDs). IBM uses CSDs to distribute both patches and minor upgrades to its operating systems.

Before the IBMOS2 forum was established, the exclusive sources of CSDs were authorized IBM representatives and IBM's National Service Center (NSC) bulletin board system in Atlanta (404-835-6600). In the process of making the fixes available on CompuServe, IBM made them significantly easier to obtain for a great many OS/2 users.

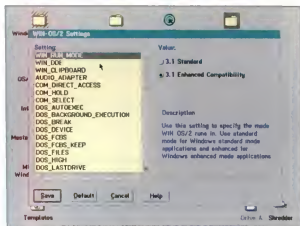
The IBMOS2 CompuServe forum became so popular that IBM split it into four separate forums; one for OS/2 support, one for OS/2 users to talk to each other, and two for developers. The company also added a library area so that users could download the CSDs without ever having to go into one of the forums.

Finally, IBM established a direct support line for OS/2 users who don't have access to a modem or who need immediate support. The support line costs \$129 a year, although the first 60

days are free. IBM also offers OS/2 with a 90-day money-back guarantee. If technical support personnel fail to get a user up and running, IBM has promised to refund the purchase price with no questions asked.

The company also established a compatibility laboratory within its Boca Raton facility so that it could test its new operating system for compatibility with machines made by other vendors. The laboratory also publishes a frequently updated list of third-party machines that have been certified as OS/2-compatible; the list is available in ASCII form on both CompuServe and on the NSC BBS.

There are still occasional complaints about IBM's support, mostly regarding the amount of time it can take to get a response to a problem. However, IBM has been very open about bugs in OS/2 and is constantly posting fixes on the on-line services. Many technical problems can be solved by using these fixes; longtime observers of IBM say the amount and quality of support provided for OS/2 2.0 is a major improvement over the company's support in the past. □



The WIN-OS/2 settings screen now includes options for running Windows in Standard or Enhanced mode.

uting beta copies of 2.1 on CD-ROM; however, at press time they had not yet announced that a CD-ROM version of the release software would be available.

The CONFIG.SYS settings haven't changed, so all the information we provided in the recent Lab Notes on tuning OS/2 2.0 (*PC Magazine*, March 16, 1993) still applies to 2.1. The only new settings we found were device drivers for SCSI and CD-ROM, and multimedia support. There have also been a number of changes in the DOS and WIN-OS/2 settings, including the new settings for Windows 3.1 Enhanced-mode compatibility.

IBM expects the list price for Version 2.1 to remain at \$199, but has not disclosed details on upgrade costs. In the past, every upgrade has been provided to OS/2 users free of charge.

PERFORMANCE

Since we were looking at a beta copy, we didn't do any formal benchmark testing. However, we did run a number of informal tests on both the beta software and the latest version of 2.0 to find out if the system's performance had improved. The answer was a resounding "yes."

The 32-bit graphics engine shipped last fall ran noticeably faster than the 2.0 version, and the engine in 2.1 is even better; windows popped open more quickly and screen updates were much quicker. The new video drivers seemed to make the screen both sharper and brighter. We did encounter a few bugs in the video drivers, particularly when resizing Windows applications running on the desktop. However, this is to be expected in

beta software. The documents included with the beta listed all the bugs we found and suggested temporary workarounds. The documents state that IBM will fix these bugs prior to release.

The overall performance of DOS and OS/2 applications appeared to be the same as OS/2 2.0 with the ServicePak installed. We used the default settings on both systems, and the only difference we noted was the snappier screen response. We did note, however, that the installation process only sets the HPFS cache to 512K, which is rather small for a 16MB system. Before doing our comparisons, we increased the cache to 2,048K.

The biggest change we found was in WIN-OS/2 sessions; OS/2 2.1 shows the same increase in performance over 2.0 that Windows 3.1 demonstrated over 3.0. We ran *PC Magazine Labs' Windows Application Performance* tests, which run a system

through three foreground tasks while a disk-intensive or screen and CPU-intensive application runs in the background. Each test element can also be run individually. Instead of strictly measuring CPU or disk performance, these tests simulate actions a user would take in each application.

The disk-intensive tests have Superbase 4 running a database sort, update, and delete in the background. The foreground applications consisted of Microsoft Excel 4.0, Lotus Ami Pro 3.0, and Corel Systems' CorelDRAW 4.0. The Excel tests perform a series of spreadsheet merges, cut-and-paste operations, charting, and recalcs, and also print one page of the spreadsheet. The Ami Pro portion scrolls through a long document, moves text around, adds a graphic, flows the text around the graphic, and prints the final copy. The CorelDRAW portion of the test calls up a complex drawing, alters some portions of it, rotates it 180 degrees, and then prints it.

We ran the tests on a Compaq Deskpro 486/33 with 16MB RAM and a 300MB hard disk. The two OS/2 systems

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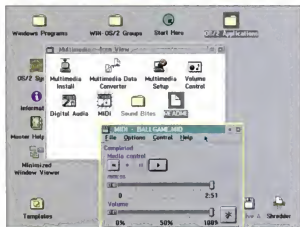
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Support for multimedia applications is available through Multimedia Presentation Manager/2 (MMPM/2).

used the HPFS. In both cases, we found that 2.1 runs anywhere from 50 percent to 100 percent faster than Version 2.0. WIN-OS/2's performance was similar to that of Windows 3.1 running on the same system. The Windows 3.1 system was appreciably faster when run on an otherwise identical system equipped with a graphics accelerator card. We can't draw any firm conclusions from this difference,

though, as the 2.1 beta didn't include SVGA drivers for the Compag SVGA card in our test system, so it didn't take advantage of the potentially higher performance an accelerator card provides.

We also found that OS/2 2.1 fixes many of the problems in the WIN-OS/2 session of Version 2.0; notably, the Clipboard and DDE support were better. In 2.0, the performance benchmark suite sometimes failed because the Clipboard ran out of memory. On the 2.1 system, the tests ran without a hitch. Windows under OS/2 2.1 is as stable as Windows 3.1 itself under certain conditions.

Windows applications also performed much more smoothly under 2.1, aside from the small bugs in the video routines. We had no problems running multiple copies of the Program Manager on the desktop and starting different applications from each one.

We have received some reports that

many 16-bit Presentation Manager applications failed to run under earlier versions of the OS/2 2.1 beta. We ran a couple of 16-bit and 32-bit PM applications on the latest beta and didn't have a problem with any of them. Whatever compatibility problems existed with earlier versions of OS/2 software in early betas seem to be solved in this one.

We used a Sound Blaster Pro to test both the OS/2 MMPM/2 and WIN-OS/2 sound systems. The OS/2 sounds worked fine, as did the included utilities that play WAVE (.WAV) and MIDI (.MID). We had a few problems getting the Sound Blaster to work properly in a DOS or WIN-OS/2 session, though again this is a known bug that IBM promises to fix by release.

THE COMING OS WARS

Overall, we were very pleased with the appearance and performance of OS/2 2.1, even as a beta product. We did not encounter any bugs that IBM didn't already know about. Windows 3.1 compatibility works as promised. In some

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need retraining and new hardware? When will their product be available? A year from now? Two? Can you wait that long? Furthermore, have their systems been thoroughly tested?

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ways, IBM has fulfilled its promise of "Better Windows than Windows."

The big question now is the future of OS/2. With Microsoft's Windows NT and a number of GUI-based Unix systems on the brink of release, the battle for the hearts and minds of PC power users is under way. Microsoft claims that Windows NT will have all the power now available in OS/2 2.1, including support for DOS and Windows 3.1 applications. Microsoft is also promising support for 16-bit OS/2 applications. There are two other areas where NT may have an advantage over OS/2: security and support for multiple processing systems and source code-compatible versions for a number of RISC CPUs. NT also builds in peer networking services, which OS/2 is sorely lacking. On the Unix side, the NeXTStep operating system provides support for most DOS and Windows applications, and Solaris is slated to do the same.

Even IBM is planning its own competitor to OS/2 2.1, in the form of the Taligent operating system under develop-

ment with Apple Computer. IBM has disclosed that work continues on a version of OS/2 based on the Mach Unix kernel that will run on non-Intel systems.

Ironically, OS/2 2.1, which was criticized initially for its power requirements, may now have the advantage of demanding fewer system resources than its competitors. Windows NT will need 8MB to 16MB RAM and 50MB to 70MB hard disk space. Unix is notorious for being resource-intensive, and both Solaris and NeXTStep require at least as many resources as will NT.

The long-anticipated 32-bit OS/2 applications are starting to appear. Lotus has released OS/2 2.x versions of 1-2-3/G and Freelance and has promised a 32-bit version of Ami Pro. Thirty-two-bit versions are also available for CorelDRAW, Micrografx Designer, and the Describe 4.0 word processor. WordPerfect has announced that a PM version of its flagship word processor will be released when WordPerfect 6.0 for DOS comes out later this year. Borland's release of a 32-bit OS/2 version of its C++

compiler should speed application development.

OS/2 2.0 has a year's head start on its competitors, and IBM has used that time well. It has made Version 2.1 compatible with existing DOS and Windows applications while ensuring continued support for new 32-bit applications. OS/2 sales have been increasing, and user interest continues to grow.

Is OS/2's momentum enough to keep it ahead of the pack or will Windows NT or a Unix contender come out on top? The answer depends on how well the other operating systems maintain compatibility with existing applications while moving their users to the 32-bit world. The moderate sales of OS/2 1.x taught both IBM and Microsoft that users are only willing to move to a new operating system platform if they don't have to give up their investment in current applications. The next year or two will tell which company has learned this lesson best. □

JOE SALEMI IS A CONTRIBUTING EDITOR TO PC MAGAZINE.

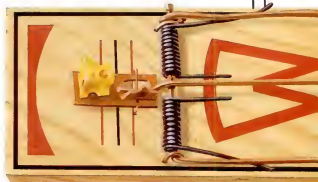
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UNIX ON INTEL

The Beast Turns Beauty

With 32-bit power, sophisticated GUIs, and support for DOS and Windows, a united Unix might finally crack the mainstream marketplace.

by David S. Linthicum and
Steven J. Vaughan-Nichols

Windows NT or OS/2—that is the question. Or is it? As the 32-bit operating system war heats up, we can't overlook an important player in the market: Unix. It's not the Unix of years past—the one that users found intimidating. It's a new, high-powered, beautified Unix. Today's Unix systems combine a powerful 32-bit operating environment with the well-built graphical front ends that users demand. And today's Unix vendors are proposing another welcome addition: a standard. Six of the industry's top players have agreed to standardize their Unix operating systems, presenting a united front in the battle against IBM's OS/2 and the forthcoming Microsoft Windows NT.

We've all heard the stories: "Unix is slow on the PC"; "Unix is difficult to use"; "Unix is impossible to install"; "There are no applications available." Without question, Unix has a beastly reputation in the PC world, and some of



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HIGHLIGHTS

Unix on Intel

IT'S TIME TO CHOOSE which 32-bit operating system will take your organization into the next century: OS/2, Windows NT, or a Unix-based system. With its historic stability and powerful new graphical interfaces, Unix is proving a viable option.

SUPPORT FOR DOS AND WINDOWS means that you can migrate to Unix without leaving your favorite applications behind. DOS and Windows support is limited, though, and varies from system to system.

CORE, the Common Open Software Environment, a set of standards recently adopted by six of the industry's top vendors, promises to unify the traditionally fragmented Unix operating system. This should help eliminate some of the confusion caused by the existence of various (and competing) versions of Unix.

those concerns are still valid. But 32-bit operating systems are on the fast track to success, and the advent of high-powered, low-priced CPUs means that more desktop users can tap into Unix's unique capabilities.

Unix, the first 32-bit operating system for machines based on Intel chips, is also one of the oldest; it was introduced almost a decade ago. Today, as an operating system it provides the additional horsepower required by many specialized applications such as CAD/CAM, imaging, real-time process control, database servers, CASE, and sophisticated software development projects. Besides its acceptance by the usual scientific users who have been sold on Unix from day one, Unix has found a home in the government (mainly the Department of Defense) and can also be spotted in financial firms on Wall Street.

You must beware, though: Unix is not an operating system for everyone or every application. You should consider a

UNIX IS A MULTIUSER system as well as a multitasking one, meaning that a single 386 machine (or preferably a 486) can do the work of a minicomputer costing 10 to 20 times as much.

ANOTHER STRENGTH of Unix is its superb networking capabilities. The engine has several built-in networking tools, including utilities for transferring files and logging in remotely. Unix networks also have excellent stability, which makes them ideal for mission-critical applications.

THE DARK SIDE of Unix cannot be ignored, however. Unix systems are still relatively tough to install and to administer, though vendors are improving these shortcomings. There are not nearly as many applications written for Unix as there are for DOS and Windows, and the system requirements can be steep, too.

move to Unix carefully before actually taking the plunge. Many of the advanced features of the Unix operating system may be a dream come true for some and a nightmare for others. What's more, the minimum system requirements that the most advanced products demand may

Many of Unix's advanced features may be a dream come true for some and a nightmare for others.

make a move to Unix quite expensive.

In this issue we look at Unix operating systems capable of running DOS applications, including Microsoft Windows and the applications written for it. The ability to provide some sort of user-friendly

graphical interface from the native Unix environment was also a criteria. The products we reviewed include Consensus Corp.'s namesake V 4.2 operating system (at the time of our testing, Consensus did not support DOS or Windows, but the version expected to ship around the same time as this article will have it); Dell Unix System V Release 4, from Dell Computer Corp.; SunSoft's Interactive Unix, Version 3.0.1; The Santa Cruz Operation's SCO Open Desktop, Version 2.0; and UnixWare from Univel. Two of the handsomest systems, SunSoft's Solaris for x86 and NeXT's NeXTStep for Intel Processors, were still in beta at the time of this review but should be shipping shortly after this article appears; both products are discussed in sidebars to our main article.

SHARED ROOTS

Unix is a highly modular and open system that has evolved over time (see the sidebar "Unix's Non-Intel Heritage" for more information). The most common Unix kernel, or engine, is currently based on the Unix put out by Unix System Laboratories (USL). The newest versions are System V Release 4 (SVR4) and subsequent maintenance releases to SVR4.2 (which is also called Destiny). At the time of its release, SVR4 was the pinnacle of the movement toward a single, united Unix. It was designed to combine all the virtues of the disparate members of the Unix family into one operating system.

SVR4 combines the best features of the Berkeley Standard Distribution (BSD), SCO's Xenix (an early x86 Unix variant), and AT&T's System V Unix.

All of the products we tested, with the exception of Interactive, NeXTStep, and SCO Open Desktop, are based on either SVR4 or Destiny. (NeXTStep uses the Mach kernel; Open Desktop and Interac-

Our Contributors: STEVEN J. VAUGHAN-NICHOLS is a contributing editor to *Computer Shopper* and the head of Vaughan-Nichols & Associates, a computer consulting firm. DAVID S. LINTHICUM is a Unix OS expert currently working for Mobil Oil Corp. HEIDI PATTON is an editorial assistant at Vaughan-Nichols & Associates. NOEL-MARIE TAYLOR is a free-lance writer and a technical writer for Ki Research, a networking and interoperability company. MARK WALLACE is a computer security specialist and a free-lance writer.



EDITORS' CHOICE

• UnixWare

tive use an earlier System V kernel.) USL licenses its Unix code to vendors, which then revamp and resell the product. Each adds enhancements to make its particular offering more attractive to potential buyers.

Dell, for one, invested so much time and effort into enhancing the SVR4 engine that it opted not to follow USL's upgrade path to SVR4.2. But while some vendors, like Consensus Corp., have done relatively little to differentiate their products from the original USL kernel, others, like NeXT, have created environments that have little in common with the Unix legacy.

Tracing Unix versions back to their USL origin doesn't always tell you much about the system features. For example, Open Desktop, even though it's based on System V Release 3.2, provides many of the features found in System V Release 4.2. This has led to some "version confusion" among potential Unix buyers. When making a buying decision, you need to examine the features first and the Unix heritage second.

GETTING COSE-*y*

Unix vendors have recognized that such disparity lessens the appeal of all Unix systems. With IBM's push behind OS/2 and Microsoft's larger-than-life launch of Windows NT, Unix makers are preparing an offensive of their own. HP, IBM, SCO, SunSoft, Univel, and USL have agreed to support the Common Open Software Environment (COSE) to unify the fragmented Unix OS.

The environment would standardize Unix components ranging from the GUI and networking aspects to graphics and multimedia. Whether this latest attempt to bring a higher order will succeed—and where it will leave non-COSE vendors, such as NeXT—remains to be seen. Still, this is an important salvo in the war for the desktop.

THE CASE FOR UNIX

Why should you consider Unix the operating system that you should ride into the next century? The foremost and most convincing reason is that the operating system has built-in multitasking capabilities. Of course, Windows NT and OS/2 both have this ability, but Unix gives them

With the "open" Unix effort moving ahead at full tilt, trying to predict a winner in this race is like trying to guess how many jellybeans there are in a jar. For an operating system that's been around as long as Unix has, its strength as a GUI environment on

the Intel chip-based desktop is still a fairly unknown and untested quantity. Of the products we looked at, the Unix system that seems to have the best grasp of the Intel market is Univel's UnixWare.

UnixWare offers end users a well-implemented blend of multitasking, multiuser, and networking capabilities (both TCP/IP and NetWare). It provides excellent DOS compatibility and a solid GUI. Add to the blend an aggressive price and professional end-user documentation and you've got the elements of a winner.

Of course, all of the Unix systems reviewed here have their strengths. Visix's Looking Glass running on Interactive Unix or SCO Open Desktop gives you a great GUI environment. Consensus offers cutting-edge multiprocessing. Dell adds a ton of Unix freeware and the benefit of a tightly integrated hardware environment.

one better: It is also multiuser. This means that a single 386 or better PC can support as many as 120 users simultaneously, in much the same manner that a minicomputer (like the DEC VAX) can. All of the processing takes place in the PC on a single CPU.

The users are connected by means of asynchronous connections, using terminals to communicate with the operating system and applications. This type of connection is usually facilitated by a multipoint board that allows the computer to accommodate additional serial connections beyond the standard COM1 and COM2. Using a high-end 386 or 486 PC with a large amount of RAM (16MB or more), you can create a surprisingly fast

It alone combines all of these into one package. UnixWare successfully connects the strengths of a technically superior Unix with DOS and NetWare. The DOS/NetWare integration opens the door to running a good portion of the existing DOS and Windows applications.

A hearty honorable mention goes to NeXTStep. Although NeXTStep wasn't ready for full testing at the time of this review, its object-oriented environment, impressive display graphics, and multimedia prowess make it the type of product toward which we should all be moving. Another product, SunSoft's Solaris, clearly has impressive networking capabilities. In addition, Solaris offers cross-platform integration with Sun's technologically advanced SPARC platform. Again, we'll have to reserve judgment until the company's distributed-computing model is fully implemented.

multiuser computer that can rival minicomputers costing 20 times as much.

It's impossible to overstate the benefits of a true multiuser, multitasking environment. A system administrator can connect into your system to solve a problem without shutting down all operations; users can invoke an application, get e-mail, or just receive a file without disturbing others on the system. They can even dial into their system from home by using the facilities of Unix: No matter what other tasks the system is performing at that particular time, Unix still makes time to answer the phone, connect, and provide a system log-on prompt. All the reviewed Unix products support many simultaneous users and multipoint boards.

Suitability to Task

It's a big commitment, but moving to a Unix environment may make a lot of sense for your organization. You can reap the benefits of a true 32-bit multitasking operating system without sacrificing the creature comforts of a GUI or leaving your favorite DOS and Windows apps behind.

Networking reflects a system's ability to communicate via different networking standards, and the ease with which you can install and configure communications options. Unix has a strong tradition of network communications, and all the systems deserve praise in this area. Products that received the highest scores were easier to network or were able to communicate via additional protocols.

DOS environment indicates the ease and power of interoperability with legacy DOS systems. This ability is crucial for organizations that want to convert from existing DOS systems to Unix workstations.

The **GUI integration** rating indicates how seamlessly and elegantly the GUI meshes with Unix. A system should permit a user to accomplish nearly all tasks from within the GUI, without resorting to the command line. A rating of *excellent* means that the GUI was powerful and elegant enough for us to prefer it to the command line.

A further strength of the Unix system is its unparalleled portability. Because it runs on so many different platforms, Unix is often the only choice for organizations that need to deliver multiplatform software and support to their users. Although the executables themselves can't be transferred from one Unix hardware platform to another (for example, from RISC to Intel), the program source code developed under Unix—usually C—can be moved from platform to platform with few modifications. Therefore, applications developed on a PC can be ported to other hardware platforms that run Unix (for example, DEC VAX, Sun, and IBM RS/6000). And porting an application from one version of Unix to another is even easier. This is why a software package available for one version of Unix is usually available for many others as well. Of the systems we reviewed, UnixWare stands out for its superb cross-

SUITABILITY TO TASK

Product Name

	POOR	FAIR	GOOD	EXCELLENT
Networking	●	○	○	○
DOS Environment	●	●	○	○
GUI Integration	●	●	●	○
Administration	●	●	●	●
Multitasking	N/A			

Unix workstations are powerful beasts and require maintenance. For the **administration** category, we evaluate how much maintenance is required and how well the system facilitates that maintenance. We consider the system administration tool that each product provides, as well as the utilities for installing new software. Products that scored highest in this category let users perform some if not most administration tasks through the graphical interface.

Unix is designed from the ground up to be a **multitasking** operating system. This rating represents how well the system performed under a variety of process loads (the number of jobs running on the system), and how much protection the system offered against the perils of multitasking. A higher score means that the system not only performed well under most conditions, but it also protected against more uncommon sources of disaster.

platform integration.

Application developers further benefit from the accommodating environment that the operating system provides to software developers. The software development tools that are available on most Unix systems include many powerful utility programs and other facilities that make application development on Unix a breeze (for more information, see the sidebar "Unix Development Tools").

For end users, the potential of Unix can be best realized by the several hundred utility programs that are available. Although many of the utilities are moored in rather cryptic commands, once you learn them they are quite powerful, particularly when performing such activities as text processing, file management, and even modem communications.

We should also note that all the Unix versions reviewed give the lie to the base canard that Unix is unstable. Interactive

took abuse above and beyond the call of duty better than the others, but all of them are rock-solid under normal or even slightly abnormal conditions.

EASY, STABLE NETWORKS

Unix is also designed for easy network use, especially with the release of SVR4.2, for which USL made a point of enhancing the networking capabilities. SVR4.2 allows network administration to be performed across the network, and network service requests from remote machines to be handled by a new "port monitoring system." Even multiprocessing tools are built into the operating system, allowing processor workloads to be shared across a network.

Unix has several built-in networking tools, including *ftp* (file transfer protocol), *rlogin* (remote login), *rfs* (remote file copy), TCP/IP, and *uucp* (Unix-to-Unix copy). Additionally, Unix has powerful network add-ons available, such as the peer-to-peer NFS (Network File System), the less popular RFS (Remote File System), and the new AFS (Andrew File System) built for wide area network use. These add-ons allow users to share file systems and network resources such as laser printers, CD-ROM drives, and modems. All of the Unix versions reviewed here support at least one of these network protocols.

Many DOS-to-Unix networking solutions are now available and supported by major network vendors. Univel, a Novell subsidiary, makes products that connect out of the box to NetWare networks. Other solutions, such as DOS-based NFS systems, let DOS-based PCs connect to the NFS Unix network.

Because Unix can accept additional low-level device drivers and offers a flexible file system, multitasking capabilities, and a large base of communications software, it is a natural for networking. Certainly it's in the running with Windows NT and OS/2. In addition, Unix systems don't crash easily, making them an especially good choice for mission-critical computers such as file servers and database servers. Program errors that ordinarily would send OS/2 and Windows into a "hard lock" would wipe out only a single Unix process, allowing other processes on the system to continue.



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Until now, most network interface cards for the LaserJet could only look in one direction. And over time, that restriction proved to be inefficient and costly.

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Unix's Non-Intel Heritage

by David S. Linthicum

The Unix operating system has been running on computers for nearly 25 years. Although the Intel x86 market has boosted the use of Unix on workstations, it is the non-Intel platforms such as RISC, SPARC and others that provide the processing power for the majority of Unix-based computers in use today.

UNIX PAST

Unix's origins can be traced back to 1969 and a pair of AT&T programmers named Ken Thompson and Dennis M. Ritchie. Unix Edition 1 was born when they created a single-user operating system to run Space Travel, a game on a DEC PDP-7 computer. They wrote Unix in C, a brand-new and shaky programming language. But because the C language is highly portable, it wasn't long before versions of Unix were created for other processors.

The evolution of Unix became complex when Unix divided into several distinct "flavors" for different hardware platforms. The Xenix flavor of Unix, from Microsoft Corp., became one of the first to run on Intel microprocessors. The BSD version, devel-

oped at the University of California at Berkeley, found a home on many high-powered minicomputer platforms. Unix 2.0, the predecessor of the currently popular System V Unix from AT&T, re-

Also, notice how versions were combined to form new flavors of the operating system. Combining releases to form a hybrid seems to be the current trend, apparent in the newest release, SVR4.2.

Notable Unix flavors include AIX as well as the IBM RS/6000 operating system; OSF/1, from the Open System Foundation; Solaris, from SunSoft (see the sidebar on Solaris); and Mach (the basis of NeXT-Step, which is discussed in a separate sidebar).

UNIX PRESENT

The fight is on: Who is going to process Unix on the workstation? (See the related platform story elsewhere in this issue.) When RISC processors first came onto the market several years ago, they became the Unix "power" platform. The multiuser, multitasking Unix operating system required much more than the Intel processors could offer. Unix hardware and software vendors (such as MIPS, DEC,

Sun, and Data General) rushed to deliver Unix-based workstations powered by new RISC processors; they caught a good portion of the high-end Unix workstation market. And the processor continues to evolve, boasting such

The Unix Family Tree



ceived the most attention and is today's standard for Unix systems based on Intel chips.

The diagram shows the Unix family tree from 1969 through today. Notice that Unix splits into several releases.

X WINDOW OF OPPORTUNITY

The most important trend in the Unix arena—one essential for Unix to become a mainstream operating system—is the evolution of Unix's GUI environment. Enter X Window, which provides the standard user-interface development environment that most of the Unix systems on the market support. X Window is a set of programming tools for controlling how information is moved and retrieved on a graphical display. Like Unix itself, X Window provides excellent portability from one platform to the next. This port-

ability makes it easier and less expensive for vendors to supply front-end GUIs with their Unix systems. Except for NeXTStep, all the products reviewed here use X Window as the foundation for their GUIs.

While the behavior of windows is governed by the X Window standard, their appearance is not. That's where window managers like Motif and Open Look come in (Open Look is SunSoft's proprietary manager, which will be phased out under the COSE agreement). Window managers refine the Unix system's be-

havior and define its appearance. These managers are the bricks and mortar from which true GUIs can be built. And while some vendors will sell you "GUIs" that consist merely of the basic X Window system and a windows manager, these alone do not a GUI make. To match the full functionality that OS/2 or Microsoft Windows provides, you'll also need a desktop manager.

All of the products reviewed here have some sort of desktop manager. Some companies provide their own desktop managers to bind the X Window sys-

RISC-like features as superpipelining, two-level cache memory, and an on-board translation look-aside buffer (TLB). The new RISC CPU boast external clock speeds of up to 75 MHz and internal clock speeds of over 150 MHz with a 62-bit data path.

Intel processors are becoming more RISC-like, though. The new Pentium chip from Intel reputedly operates at over 100 MIPS, almost twice the speed of the 486DX2. Not surprisingly, this processor supports 32-bit and 64-bit data paths, and RISC-like features such as superscalar architecture and an advanced floating-point unit (FPU). Many former non-Intel Unix vendors (such as SunSoft, NeXT, and the Apple-IBM alliance) are now porting to Intel.

UNIX FUTURE

Even with the advances Intel made with the Pentium chip, the RISC vendors have managed to keep just a few steps ahead in CPU performance. But not without a price. Though prices are falling as competition with high-end Intel designs heats up, a fully configured Unix RISC workstation can still cost upward of \$15,000.

When all is said and done, the future of Unix on non-Intel platforms may rest with Intel. Even if Intel is a few ticks slower than RISC, the tons of software one can purchase for an Intel-based system—including the Unix operating system and Unix applications—may make Intel the best value in the Unix arena of the future. □

tem together and give users a complete GUI, while other companies use third-party desktop managers. Dell and SCO, for instance, use IXI's X.desktop; for Interactive, SunSoft uses Visix Software's Looking Glass. The overall result is the same: a GUI that's as fully functional as those in the IBM or Microsoft operating systems. But be warned: The system resources that these GUI delights require are steep—typically higher than the resources you need for running Windows.

Unlike Microsoft Windows or OS/2 Presentation Manager, X Window is a

network windowing system based on the client/server model. The system is divided into three parts: the display server, the client application, and the protocol linking them together. Programs can be executed on a remote computer and the results displayed on a local X Window server.

The display server facilitates client display capabilities, keeps track of user input and client application programs, and also acts as an intermediary between client application programs and the local display hardware. The client application makes requests to the server.

This division in the X Window architecture allows the client applications and the display server to work together on the same machine or to reside on different machines that are connected by a local network. Since X Window terminal emulators are available for Microsoft Windows and DOS, DOS-based PCs can operate an X Window server and act like an X Window terminal.

X/Open, an association of many computer manufacturers who support the X Window standard, spends a great deal of time and resources controlling the quality and compatibility of the standard. This is important, since so many GUIs depend on X Window. It's also important to note that the X Window system is not part of any operating system but instead consists entirely of "user-level" programs. This fact alone makes X Window very open and portable. X Window is not exclusively a Unix product; it can and does run as easily on VAX-VMS or DOS (for example, under Quarterdeck's DESQview/X) as on Unix.

KEEPING THE DOS GUYS SATISFIED

In order to satisfy their Intel-based clientele, Unix, OS/2, and Windows NT are all able to run DOS and Windows applications as a compatibility option—some more successfully than others. While Unix proper can't run either DOS or

Windows applications, the 32-bit environment offers a way out of this by enabling the operating system to run virtual 8086 and 286 machines.

In this feat of computing magic, a mapped protected mode of the Intel 386 or better processor can be used to set up an environment for any application, including an operating system, that it is

running in its "own" 8086 or 286 computer. EMS memory emulation is even supported for DOS applications that require it. What this means in practice is that you can run real DOS in windowed or full-screen environments with software like Insignia Software's SoftPC, Locus Computing Corp.'s Merge 386, and Phoenix Technologies' VP/ix. As long as your application software doesn't test DOS's limits (like Lotus 1-2-3, Release 3.1, does by using a rather pushy DOS extender), your apps should run just fine.

DOS applications that access the devices directly

may also cause problems. For example, just because your network adapter can connect to a NetWare server from DOS does not mean that you can do the same under Unix using a DOS emulator. You may also run into unpleasant surprises if you try to run Windows 3.1 in Enhanced mode on currently available Unix systems because Windows itself would be in direct conflict with Unix for control of the processor.

Windows 3.1, in many cases, can be run in these environments in Standard mode, which is tolerable. (OS/2 manages to run Windows in Enhanced mode because IBM has access to Microsoft's Windows code.) All DOS emulators can run Windows 3.0 in Real mode, but doing this limits the number of Windows applications you can run, since many do not support this operating mode. The bottom line: You should not purchase Unix to run DOS per se, but converts from DOS and Windows will be happy to know that they do not have to leave their favorite applications behind.

*X Window is not
part of any OS,
consisting
entirely of
"user-level"
programs. This
fact alone makes
X Window very
open and
portable.*

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Our performance tests, which simulate a real-world environment, revealed relatively slight differences among the various Unix systems. To put the performance of Unix systems in perspective, we wish to point out that a single-user implementation of Microsoft Windows running on top of DOS bests these Unix versions in terms of speed. But this is to be expected: As a multitasking, multiuser operating system, Unix does a lot more at any given moment than Windows does.

What the Numbers Mean

The numbers indicate that all of these systems are adequate performers: None of them will have users tapping their fingers impatiently. UnixWare was the slowest of these systems, but as we noted earlier, the time differences between the slowest and the fastest systems are very small. Also, as we moved from a single user on the system to five users, these Unix systems showed only a relatively slight degradation in speed—a testament to Unix's ability as a strong multi-user operating platform.

We should add that at present, there is no foolproof way of measuring 32-bit operating-system performance between disparate operating systems. Low-level benchmark tests such as Dhrystones (which measures integer mathematics) tell us more about a processor's performance and a compiler's efficiency when it comes to a particular machine architecture than it does about the operating system. And unfortunately, high-level, application-oriented benchmark tests suffer from the problem of not being reproducible. What the numbers do give us, however, is an overall impression of the relative speed at which mainstream applications will perform in each environment.

We should also note that any of these systems could doubtlessly perform better with intensive tuning. Unlike DOS machines, Unix systems have a wide variety of parameters that are especially sensitive to how RAM is allocated. We tuned all these systems to the same settings. If you purchase one of these products, we advise you to pick up a copy of *System Performance Tuning*, by Mike Loukides (ISBN: 0-937175-60-9). We believe that you can squeeze at least 10 percent more performance from each of these systems if you configure them to their optimal specifications.

How We Tested

We ran these tests on a Compaq Deskpro 486DX/33 system with 16MB of RAM and a 330MB hard disk. We also equipped our test system with an EISA motherboard and standard Compaq Super VGA graphics.

We asked each vendor to come up with the word processing and spreadsheet applications that it believed would perform best on its operating system. Without exception, each vendor chose WordPerfect for Unix Systems, Version 5.1, and Lotus 1-2-3 for Unix System V, Version 1.1. Both of these applications are X Window–based implementations created for Unix platforms. We ran each of our tests three times, timed the results manually, and computed an average.

Because OS/2 2.1 and Microsoft Windows NT were not yet available at the time of our testing, we choose to look at Windows for Workgroups for performance comparisons. Windows for Workgroups is a peer-to-peer workgroup GUI environment that is functionally similar to Unix in many ways. For the Windows tests, we used Lotus 1-2-3 for Windows, Version 1.1, and WordPerfect for Windows, Version 5.2.

Our test suite included portions that tested how quickly each Unix system launched Lotus 1-2-3 and WordPerfect from the GUI. Since the differences among the times were insignificant—Lotus 1-2-3 typically took less than 1 second to load and WordPerfect around 2 seconds—we chose not to present these results in a separate graph.

For the Lotus 1-2-3 **Matrix Multiplication** test, we set up two matrices of six-digit numbers; each matrix is 30 cells by 50 cells. We then have Lotus 1-2-3 multiply each number by its counterpart, located in its twin matrix, to produce a third matrix. The scores show the time each operating system took to complete the task.

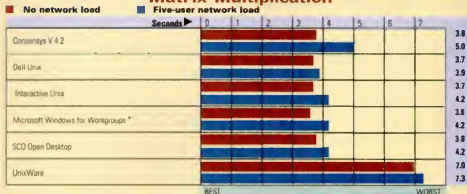
For the Lotus 1-2-3 **Loan Calculation** test, we have Lotus 1-2-3 determine the monthly payment on a 30-year mortgage at x interest for y amount. We insert values and time how long it takes for the application to calculate the amount.

The WordPerfect **Spell-Check** test score is simply the time a system took to spell-check a 20K test file under the application.

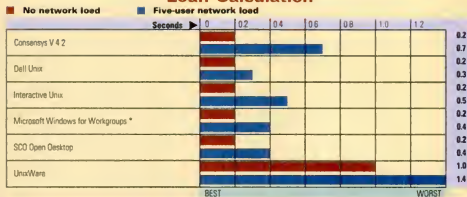
For the WordPerfect **Sort and Shuffle** test, we run a macro that flips the last paragraph of our test document to the first-paragraph position, the second-to-last paragraph to the second-paragraph position, and so on until every paragraph had been moved.

LOTUS 1-2-3

Matrix Multiplication

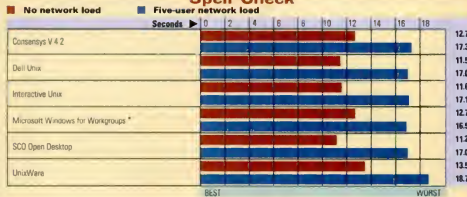


Loan Calculation

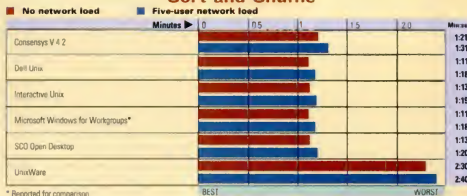


WORDPERFECT

Spell-Check



Sort and Shuffle



* Reported for comparison

UNIX'S DARKER SIDE

Unix never won the hearts and minds of many x86 users for several reasons. First, raw character-based Unix is not built for humans. Users found the cryptic two-character commands and lack of usable help frustrating. Second, compared with good ol' DOS, Unix is a resource hog: Most of the products reviewed here each need at least 8MB of RAM and as much as 100MB of disk space just to get the operating system and GUI up and running. You are going to need at least a 386DX-based PC to get by, and in many cases a 486 is recommended to handle the Unix beast. While this same gripe applies to Windows NT and OS/2, there's no getting around the fact that the resource requirements alone make Unix a little too expensive for some.

Installing a Unix system can be a chore, and administration can be a bear. And although Unix shrink-wrapped software is no longer the oxymoron it once was (for years Unix programs had to be recompiled on every new system), installing programs to work to your best advantage can be a pain in the neck. Once properly set up, however, a Unix environment is as robust and easy to use as any other mainstream operating system.

Another black mark against Unix is that it is not as application-rich as DOS and Windows. While there are vertical-market applications galore, only a few of the major software vendors have embraced Unix. So, for example, you can get WordPerfect but not Ami Pro. You have Lotus 1-2-3 but not Microsoft Excel. It's this limited choice of applications that does Unix in for many markets. OS/2 suffers from the same problem, and the jury is still out on Windows NT.

Performance is also a concern. From the user's perspective, Unix appears to run more slowly than do Windows or OS/2 on the same architecture. The explanation from Unix vendors is that Unix is just doing more at any given time. This is true. Unix is constantly running scheduling programs, printer spoolers, and other maintenance software. Still, that won't stop anyone who is used to the speed and snap of a single-user operating system from drumming his or her fingers impatiently. As the GUIs get more sophisticated and as additional features

such as security are added, Unix is likely to get even slower. The hope for Intel-based Unix products lies with the new pumped-up processors such as the Pentium chip, which helps bring RISC-like processing power to the desktop more affordably.

When evaluating the cost of a Unix system, sticker shock is not uncommon.

But while the price tag might seem out of line at first glance, when you add in the cost for all the additional software to achieve the same functionality, Unix may be a bargain. All the Unix systems we looked at come with a host of utilities—e-mail, schedulers, and so on—that other operating systems don't supply. Many of them also bundle features such as development systems, network software, and GUIs.

Dell, for one, includes a host of freeware and the development system in the basic set. Interactive has created several bundles that the Unix shopper can pick and choose from. You can select from a simple get-you-going Unix to a major network development platform with all the bells and whistles. The cutting-edge products go this approach one better by offering system-unique improvements beyond the basics. NeXT-Step, for example, has *multimedia e-mail*.

If you are going to support more than one user, make sure you find out how the different Unix vendors handle the multi-user capability of Unix. Some allow you an unlimited number of users, while some limit you to only one or two, with an option to support additional users at an additional price. Make sure you question the vendor as to what comes with your Unix product. Also, with the arrival of Windows NT, prices should start to drop. Univel, for example, recently reduced prices on its various UnixWare editions to grab some market share.

OF DOS AND DRIVERS

Hardware support is another force with which Intel chip-based Unixes must

reckon. With hundreds of peripherals and add-ons such as video, disk, and network devices—and far too few standards—matching compatible hardware with an operating system becomes difficult. The problem is exacerbated for 32-bit operating systems, since the device drivers can't use the 16-bit BIOS. It's up to the end users to make certain that the

specific hardware drivers they need actually do exist.

In the Intel-based Unix world, device compatibility is always a problem, but things are getting better. Generally, Unix products come with a certain number of standard device drivers such as low-resolution VGA, ESDI, SCSI, and IDE disk drivers; Logitech and Microsoft mouse drivers; and a smattering of additional supported devices such as cartridge tape drives and multipoint boards. Interactive, for one, includes the drivers for several brands of high-resolution video adapters, network interface cards, tape drives, and multipoint boards. If the device is not supported by the operating system vendor, then the device vendor must supply the driver. This makes some of the inexpensive network cards, video cards, and other devices poorly suited for Unix, since many may not provide the Unix driver support.

CHOOSING A PATH TO THE FUTURE

As you read the Windows NT and OS/2 stories that action on Unix, you'll see that Unix is not the only—nor the most notorious—32-bit operating system vying for the spotlight. Unix continues a slow but definite penetration into the PC world, and there are those who believe that the capabilities, power, and potential of Unix will make it the operating system of the fu-

ture. It's not for everyone; it's not even for the majority. But for small and large businesses looking for a true multitasking, multiuser OS with superb connectivity, multiplatform support, and mission-critical stability, the commitment to Unix is a viable option.

Consensys Corp.

Consensys V 4.2

BY NOEL-MARIE TAYLOR

The two reviewed products that are based on USL's latest SVR4.2 kernel are Consensys V 4.2 and Univel's UnixWare. But while the products share a common foundation, their makers have taken different paths. Whereas Univel has created a hybrid operating system aimed at a specific class of user, Consensys Corp. has taken a "no-frills" approach. The basic package is a great value, and the additional modules provide room for growth.

Consensys was the first SVR4.2 Unix to be released for the x86 processor. Because it's a standard SVR4.2 Unix, Consensys is compliant with the Intel Binary Compatibility Standard 2 (iBCS2). This means that you can run not only System V binaries, but also SCO Unix and SCO Xenix programs. Consensys has a number of attractive value-added modules, including C2-level security and X Window programming tools. Though the reviewed version lacked a DOS emulator (you can buy emulators from third-party vendors), the release that will be available as you read this will have one.

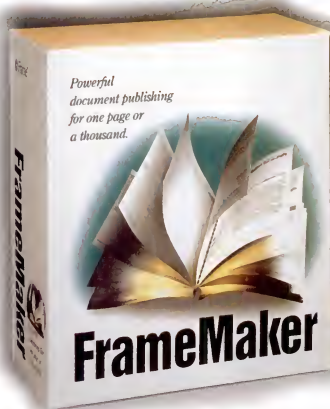
Though it doesn't offer the NetWare compatibility of UnixWare or the bundle of freeware programs offered by Dell Computer Corp., Consensys does give you the functionality of the powerful SVR4.2 kernel, including the newest X Window system (System 11 Release 5) and the SVR4.2 Desktop manager. You also get both the Motif and Open Look window managers, along with the company's proprietary TCP/IP administration utility and virtual-console

SUITABILITY TO TASK

Consensys V

	POOR	FAIR	GOOD	EXCELLENT
Networking	●	●	○	○
DOS Environment	N/A			
GUI Integration	●	●	○	○
Administration	●	●	○	○
Multitasking	●	●	○	○

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CHOOSE YOUR GUI

Upon installation, you can pick either the Motif or Open Look GUI. Both of these interfaces are easy to learn. File-administration tasks are as easy as dragging and dropping; these include copying files and moving from directory to directory (or from system to system if you're on a network). To launch an application from the desktop, simply drag and drop files onto the application's icon.

Consensusys has a relatively modest set of system requirements compared with other systems we reviewed: just 4MB of RAM and 100MB of hard disk space. In fact, only SCO Interactive Unix could run acceptably with less system resources. Consensusys also comes with a full set of Unix utilities, including awk, grep, and vi, that have standard SVR4.2 interfaces. While not as slick as the interfaces supplied with some of the other Unix versions, the desktop environment does make these programs more user-friendly and less user-hostile.

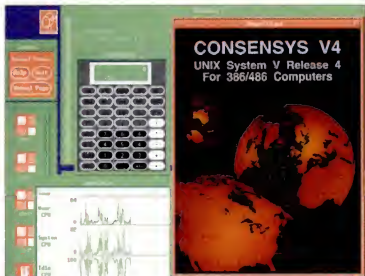
Despite the fact that it's a first-generation product for the SVR4.2 Unix family, Consensusys supports a surprisingly large number of peripheral devices, including SCSI-driven ISO-9660 CD-ROM drives and High Sierra-compatible units. Network support at present is limited to the stock NFS and RFS support provided by the kernel. Thanks to the company's proprietary TCP/IP administration utility, this set-up procedure—bestly in other versions of Unix—proves simple under Consensusys.

ADMINISTRATION AND INSTALLATION

Consensusys provides its own revamped installation and system-administration utilities.

These tools, too, have a GUI interface and are easy to use. One "gotcha" to keep an eye out for: You must install the system administration tools during the initial installation, or the module will not install properly. This problem appears to be a generic fault with the base SVR4.2 code. Another weak link we found appears to be a throwback to earlier incarnations of Unix, before the advent of the GUI: In SVR4.2 some administration tasks can be performed only by the system Owner, yet we discovered that it was possible to set up the system without designating a system Owner. Getting around this took some expertise.

Consensusys installs from quarter-inch tape or from floppy disks (expect several hours of tedious disk swapping to install the entire system if you opt for the latter method). A CD-ROM version should be available by midyear. After our initial installation, our testers could access the Unix prompt but not the GUI. It took us several more hours of searching for a well-hidden explanation in the documentation to solve the problem. Once we ran the proper commands (the elusive `/usr/Xadm/dtdeluser` user, which deletes the first desktop user, and then `/usr/Xadm/dtdadduser` user, which reinstates a desktop user), the Desktop Manager came up.



For its GUI, Consensusys employs the newest X Window system, System 11 Release 5. Users can also choose which window manager they prefer to use: Motif or Open Look.

The SVR4.2-based convention of issuing an Owner account turns out to be one of the charms of Consensusys. With Unix systems, only the root user has the ability

FACT FILE

Consensusys V 4.2

Consensusys Corp., 1301 Pat Booker Rd.,
Universal City, TX 78148; 800-388-1896,
416-940-2900



List price: Basic package for two users, \$249; complete package for unlimited users, \$1,295.

Requires: 386SX-based PC or better (486DX or better recommended), 4MB RAM (8MB recommended), 100MB hard disk

space

In short: With the power of the SVR4.2 kernel but few frills, this product is a good implementation of standard Unix. It is affordable and less of a resource hog than other Unix versions, and it boasts an improved installation utility that makes Unix less of a hassle. But until it has DDS and Windows support, shops migrating from those operating systems should look elsewhere.



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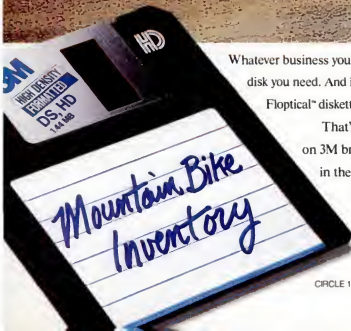
to perform such tasks as installing printers, shutting down the system, and adding or deleting users. Moreover, the user must perform these tasks from the command line, and using the root typically requires some Unix expertise. While this is an understandable security measure (after all, you don't want just any user shutting down the system), there are times when it is useful to have other people who are able to perform one or more of these tasks. With Consensusys's Owner account, the owner has all the privileges and abilities of the root user—except the ability to shut down the system—and can perform these tasks through the GUI. The owner can add new users, modify the system configuration, and add, delete, or reset printers. The owner can also give other users one or more of these privileges, up to and including giving another user complete owner privileges.

APPLICATIONS PLAYING CATCH-UP

With its SVR4.2 kernel, Consensusys can run any applications ported to the USL Unix release. Most major software vendors that have supported Unix currently have or will soon have ports to the SVR4.2 kernel. We also had no difficulties installing packages that were



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■ The NeXTStep Generation

by Heidi A. Patton and Steven J. Vaughan-Nichols

NeXT is known for its innovative operating system, which until recently has been available only with the company's proprietary hardware, the futuristic NeXTCube. But recently NeXT sold the hardware part of its business to Canon; now, to enjoy wider success, it has been working to make its software available on the Intel platform.

NeXT hopes to convince users that its OS is a more productive environment than the better-known alternatives: Windows NT, OS/2, and the more traditional implementations of Unix. So much of NeXTStep is based on cutting-edge object-oriented technology that it has often been compared with operating systems not even available yet: Taligent's Pink and Microsoft's Cairo project.

NeXT is determined to make the most of its NeXTStep for Intel Processors. The early beta we saw didn't yet contain the forthcoming DOS emulation, but it did show off the gorgeous user interface and the productive Interface Builder development environment.

produced for other Unix platforms. Grammatik for SCO Xenix, for example, ran quite well under Consensus, although both Lotus 1-2-3 and WordPerfect had to be started from the Unix command line in a terminal window rather than directly through the GUI.

Once started, Lotus 1-2-3 worked beautifully, offering reasonable performance. WordPerfect was not as successful, however. Text would not draw well on-screen, and the entire window constantly flickered when we entered information. The company suspects a compatibility problem with our VGA driver.

NEXT-GENERATION OS

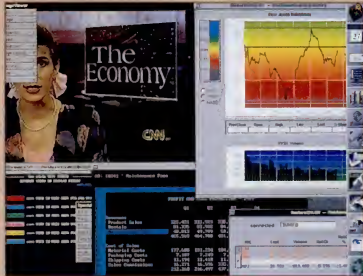
NeXT has rigorously adhered to the object-oriented paradigm in NeXTStep. The graphical environment, dubbed the Workspace Manger, is a highly designed interface where end users can easily mix

cally reflected wherever that element appears. Multitasking, networking, and multimedia are securely integrated. While multiple operations still leave Windows 3.1 floundering, NeXTStep (thanks to its enhanced Mach operating

kernel) never skips a stitch while running half a dozen operations at once. The multimedia support provides video-in-a-window capabilities and full audio support.

NeXTStep's real-time graphics amaze and delight. It is the only Unix we looked at that integrates 24-bit graphics support. The system takes advantage of the linear frame-buffer facilities available in many high-end graphics cards and employs a technique called "windows backing store," which keeps window images in either memory or virtual memory. As long as you've got RAM to spare, NeXTStep gives

you eye-popping true-color visual images that move with incredible fluidity on-screen. The technique also enables fancy visual effects like image transparency, in which images can be seen through other images. NeXTStep also includes cross-application support for



NeXTStep for Intel Processors has a user interface that's nothing short of breathtaking. With 24-bit graphics support, NeXTStep offers true-color images that move with incredible fluidity on-screen.

menus, icons, and windows into a customized interface—no third-party development tools required. File manipulation and program launching is all done by drag and drop, and NeXTStep supports Object Links, where changes made in one document element are automati-

Consensus's help facilities are more than adequate. Users can access an on-line manual from any terminal window or obtain help from almost anywhere on the desktop.

With the DOS compatibility promised by the impending upgrade and stream of SVR4.2-compatible applications, Consensus is a product you should consider. It has modest system requirements but still offers enough features to get you up and running effectively. Consensus offers the chance to create an affordable system with just the functionality you need today, and the possibility for future enhancements.

Dell Computer Corp.

Dell Unix System V Release 4

BY STEVEN J. VAUGHAN-NICHOLS

It's strange for PC users to think of Dell Computer Corp. as being in the operating system business. But in fact, Dell has a very complete version of Unix. Dell Unix System V Release 4 comes with just about every useful Unix and freeware tool, an esoteric collection that includes the elm mail interface, the perl data-manipulation language, the EMACS text

the Pantone color-matching system.

These visual delights come at a cost. NeXTStep requires a minimum of 16MB of RAM for color graphics (24MB are recommended). Moreover, NeXTStep uses 486-specific instructions and runs only on 486- or Pentium-powered machines. All that, plus the required 120MB of hard disk space for the user environment alone, adds up to an operating system that demands haute cuisine hardware.

Communications will also prove to be a strong point for NeXTStep. The Mach kernel supports object messaging, which simplifies not only interprocess communications but also intersystem communications. NeXTStep has always supported Unix's networking standards, like NFS and TCP/IP. Release 3.0, which is NeXTStep's foundation, comes with NetWare client and Macintosh Apple Share client software.

OOP DEVELOPMENT TOOLS INCLUDED

NeXT is also bringing NeXTStep's well-respected development environment to the PC world. The Project Builder component is an integrated point-and-click application for managing and maintaining development projects. The Interface Builder helps developers create user interfaces that are consistent with the look and feel of all other NeXTStep applications. For commonly used programming objects (like panels for selecting files and objects that handle data exchange and print-

ing), NeXTStep includes the Application Kit. Programmers can plug these ready-made elements into their applications or tailor them for more specific functionality. There's even an object-oriented database development tool, the Database Kit, that lets programmers build GUI front-end database apps quickly.

GOOD APPLICATION SUPPORT

Several popular programs, like WordPerfect, Adobe Illustrator, Lotus Improv, and Informix's Wingz, already exist in NeXTStep versions. The operating system itself comes with a variety of cutting-edge applications, such as a multimedia e-mail system that lets you send and receive sound and graphics elements as well as text.

We'll need to wait to see how NeXTStep handles DOS and Windows applications, though. NeXT's integration of Insignia Software's SoftPC DOS emulator was unavailable for testing during the beta cycle. SoftPC allows you to run DOS 5.0- and Windows 3.1-compatible programs in standard mode.

NeXTStep for PCs is as beautiful and awe-inspiring to look at as its picture on the on the company's sleek black boxes. Its easy-to-use object-oriented interface makes it stand apart from the other 32-bit operating systems. The steep hardware requirements may not make it the Volkswagen of operating systems, but there's always a market for a Mercedes. □

INVESTED IN SVR4

Dell Unix is based on USL's SVR4 kernel, and Dell does not plan to move to the newer version, SVR4.2. The company has opted to stay with SVR4 because it has devoted considerable time and resources toward improving the SVR4 kernel. In fact, Dell Unix ran more smoothly than the other reviewed Unix versions, and offers numerous enhancements over the stock SVR4. For example, Dell's device drivers have been designed to work with the operating system kernel so the system administrator can easily obtain I/O address, shared memory, and interrupt information for every device on the

system. Adding devices is also easier because all of Dell's device drivers automatically configure themselves: The OS will seek and find the appropriate unused address range and interrupts for a supported device. And programmers will be delighted that Dell Unix comes with the complete Unix development system for a lower list price than other vendors charge for their basic systems.

Installing the operating system, from a QIC-24-compatible tape, is simple. While it takes longer than CD-ROM installations, it's not the boring torture that installing from floppy disks can be. But be certain that you have the right equipment: Dell Unix will not work with a 60MB drive. You need one compatible with 150MB, 250MB, or 525MB tapes. The system is also available on DAT.

LONG ON PERFORMANCE, SHORT ON HELP

The applications we tested ran better on Dell Unix (even though we tested it on non-Dell hardware) than on the other systems. Dell bundles a DOS emulator, Locus Computing Corp.'s Merge, to provide DOS 5.0 support. You can run Microsoft Windows 3.0 in Real mode, but Microsoft Windows 3.1 support is not included. We found that when we used expanded memory, Merge showed an alarming tendency to slow system performance. Also, its DOS networking is not as strong as UnixWare's, since you won't find Microsoft LAN Manager or NetWare support.

TCP/IP networking, on the other hand, is well supported, and TCP/IP ran more smoothly on Dell Unix than on the other systems. While the included graphical interface didn't make TCP/IP as easy to set up as it is in SCO Open Desktop or UnixWare, it ran more solidly, resist-

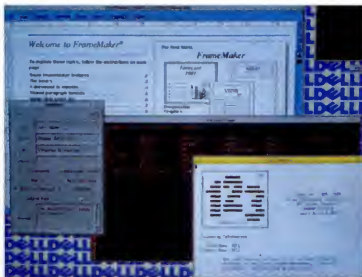
editor, the TeX typesetting language, and the Gnu C compiler

As you might expect, Dell will sell you hardware as well—in the form of a 486DX PC with the operating system already loaded. If you consider the quality of Dell's systems, this is a very tempting bundle indeed. And although Dell Unix will run perfectly well on non-Dell hardware, finding out exactly what motherboards and peripherals Dell Unix supports proved to be more trouble than it was with other vendors. Once armed with this information, though, you won't have much trouble getting the system to run on non-Dell hardware.

SUITABILITY TO TASK

Dell Unix System V

	POOR	FAIR	GOOD	EXCELLENT
Networking	●	●	●	○
DOS Environment	●	●	○	○
GUI Integration	●	●	●	○
Administration	●	●	○	○
Multitasking	●	●	●	●



Based on Motif and X Window System 11 Release 5, Dell Unix System V Release 4's graphical interface will seem encouragingly familiar to users of Microsoft Windows.

ing temporary network disconnections and the like during our testing. The operating system's Serial Line Internet Protocol (SLIP), which lets you run TCP/IP over asynchronous connections, dealt with noisy phone lines that caused other SLIP connections to falter. Dell's SLIP can also be configured and stopped without a reboot—something you can't do with some other Unix systems.

It's fortunate that Dell Unix runs so smoothly, since the documentation offers scanty help. These tiny manuals give you just enough information to get your Unix up and running smoothly. If you want more (and you probably will), Dell will sell you the Prentice-Hall System V manuals. But that does you little good when you're stuck with a misbehaving system, since these manuals are not Dell-specific.

Dell does offer a variety of help options. You can obtain OS updates directly from Dell-run Internet sites via TCP/IP (dell1.dell.com and dell2.dell.com). Dell also has a large support staff, and our experiences with technical support were uniformly positive.

TO GUI OR NOT TO GUI

Unlike the other system vendors, Dell doesn't buy into the idea that a GUI will be your first choice for an interface. Once the system is up and running, you can choose to run Dell Unix in either character or GUI mode. Users who can't live without the Unix command line will be

happy to find that Dell supplies the Korn shell along with the more common Bourne and C shells.

Once you've started using Dell's GUI, though, you will wonder why the company did not have the GUI start up automatically on boot-up. Based on X Window System 11 Release 5, the Motif window manager, and Version 2.0 of IXI's X.desktop, the object-oriented GUI

works smoothly and in ways that Windows users will find encouragingly familiar. While we prefer Visix's Looking Glass desktop manager for its customizability, X.desktop gives you excellent functionality with an icon-based interface that features drag-and-drop functionality for managing files and launching programs.

Contrasted with SCO Open Desktop

(which is based on the same windowing system, window manager, and desktop manager), Dell's interface doesn't connect as well with the underlying operating system as it might. It is, for example, easier to access the mail program from SCO Open Desktop than it is from the X.desktop interface that Dell utilizes. That said, Dell's GUI was perfectly functional.

For a Unix purist, there's much to love about this operating system, not the least being its amazingly complete collection of Unix freeware and surprisingly bug-free operation. Still, it is still hard to see Dell Unix moving out of its current market, with its SVR4 commitment and its limited DOS compatibility. Dell Unix is for users who already have a commitment to Unix, not users who want to operate optimally in Unix and DOS.

SunSoft Inc.

Interactive Unix

BY STEVEN J. VAUGHAN-NICHOLS

The oldest Unix version in this roundup is also one of the most solid. SunSoft's Interactive Unix, Version 3.0.1, has improved with age. And despite SunSoft's porting of Solaris to the x86 platform—a procedure that's still in progress and talked about frequently—Interactive hasn't been laid to rest; a new release is in the works. (For more information on Solaris, see the sidebar "Solaris 2.1: The Rise of a New Sun?")

While SunSoft is readying Solaris to accommodate after large corporations that need a distributed computing environment designed for client/server, mission-critical applications, Interactive remains a solution for small businesses that need a multiuser, multitasking operating system.

Interactive is well-suited for the task. The only drawback is that Interactive's kernel—SVR3.2—is not as compatible with applications written for different flavors of Unix as are the newer SVR4 and SVR4.2 versions of Unix.

You can purchase either a two-user version (\$495) or a network version (\$895) of the basic operating system. Most users, however, will want to opt for

FACT FILE

Dell Unix System V Release 4

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355, 512-338-4400; fax, 512-338-8700



List price: Basic package for two users, \$495; complete package for unlimited users, \$1,295.

Requires: 386-based PC or better (486 or better recommended), 4MB RAM (8MB recommended), 150MB hard disk space.

In short: This Unix product is the best of its kind. It handles multiple tasks without a hitch, and its GUI protects users from the often-confusing Unix command line. The excellent peripheral support and generous bundle of free Unix apps will continue to make it a favorite among dedicated Unix fans, but with only TCP/IP network support and average DDS support, it may not be the best choice for users looking to make the transition from DOS.

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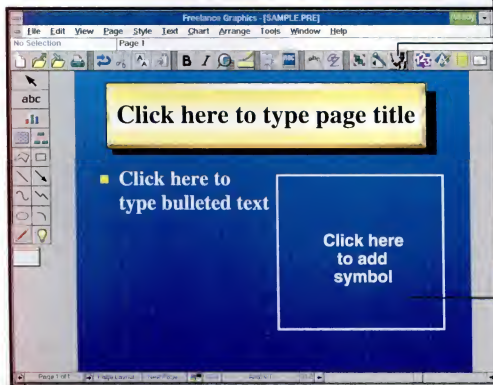
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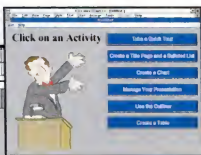
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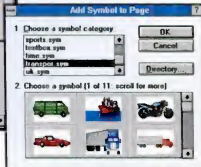


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Solaris 2.1: *The Rise of a New Sun?*

by Noel-Marie Taylor and Mark Wallace

"All the wood behind one arrowhead" has been the philosophy of Sun Microsystems as it pushed its SPARC platform and its accompanying Solaris operating system. Now SunSoft, Sun's software subsidiary, is aiming at a new bull's-eye: your desktop. As we went to press, SunSoft had just begun delivering Solaris 2.1 for x86—a Unix-based operating system that targets a wider audience than Sun's traditional high-end niche. With the official release long in the making and not yet ready in time for this review, we took a good, hard look at the beta version.

Solaris, in its earlier incarnation as SunOS, has been around since 1982 for RISC-based computers. With the rollout of Solaris for x86, Sun is touting its "distributed computing environment" concept. The company hopes to convince Fortune 1000 firms that Solaris is the right platform for their entire businesses. The focus is on integrated, mis-

sion-critical, enterprise-wide computing: hundreds (if not thousands) of machines, from PCs to SPARC-powered mainframes, all running Solaris and sharing data and information.

CATERING TO END USERS

Born from the Berkeley 4.1 version of Unix, Solaris is an operating environment designed for end users. It has a terrific collection of deskset tools that work well together. The mail tool, easily the niftiest of the set, has built-in hooks for multimedia mail, including support for voice mail and the creation of hooks for just about any kind of media you would want to ship across the network. Simply drag and drop text or any other object from one window to another.

This power is provided by an underlying package known as ToolTalk, which transparently manages the transfer of information between different application environments. Similar to the NeXTStep messaging system (see the sidebar "The NeXTStep Generation"

for more information), ToolTalk handles the negotiations about format and meaning and takes care of the communications. The operating system ships with a variety of tools such as a paint program, screen-capture program, and text editor that make use of ToolTalk.

The GUI environment that greeted us after we loaded the Solaris beta was Sun's proprietary Open Look desktop. While other Unix vendors have opted for the rival Motif manager for their Intel chip-based systems (and some vendors even offer a choice), Sun stayed with its Open Look for Solaris, mainly to ensure a common look and feel across the Intel and SPARC platforms. But with the recent COSE agreement for a unified Unix (discussed in more detail in the introduction), Sun has made a major concession for the greater good and agreed to adopt the Motif environment.

FUTURE OS TALK

Clearly, Solaris for x86 will integrate neatly into Sun's strategic information-

SunSoft's more complete configurations: Application Platform (\$985), Network Platform (\$1,315), Workstation Platform (\$1,535), and Workstation Developer Platform (\$2,635). The first of these is designed for users who will be running bread-and-butter character-based DOS and Unix applications. The network package includes complete TCP/IP and NFS software. The workstation edition adds an excellent GUI system called Easy Windows. Finally, programmers will want to get their hands on the Workstation Developer

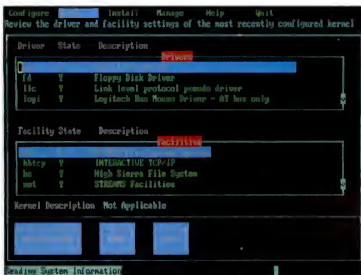
Platform, which we used for our tests. This included the TCP/IP and NFS networking protocols, the VPix DOS emulator, the TEN/PLUS user environ-

ment, the software development system, and X Window.

EASY INSTALL AND ROCK-SOLID

Installing a Unix system is not an easy job, but SunSoft has made it as painless as possible for a disk-based system. Though we would prefer to see CD-ROM installation available, even with 3.5-inch floppy disks it took us only an hour to install the entire operating system. You could spend full days installing other versions of Unix. But if you have an unusual setup—say, an IDE hard disk and a SCSI unit—be prepared to get cozy with the manuals. The information you need will probably be in there, but only a Unix systems administrator could love these manuals.

Also, to reap the full benefit of any extra system RAM you might add, you must reconfigure and rebuild the kernel; the other reviewed Unix systems handle reconfiguration more transparently.



Interactive Unix's Easy Windows GUI system, based on Visix Software's Looking Glass, is superb. For the system administrator, selecting configuration options is as easy as point and click.

management environment. The Network File System (NFS) and Network Information Service (NIS) were invented by Sun and are integrated seamlessly into Solaris. NFS lets users share file systems across the network without the need for dedicated file servers. NIS provides centralized administration services for handling user and network data files across a multinode server/workstation environment.

Sun's future strategy, which emphasizes Distributed Objects Everywhere (DOE) and Open Network Computing (ONC), is woven throughout Solaris. DOE and ONC combine to enable both data files and programs to be used and run in a distributed fashion over a network, regardless of the underlying architecture.

Another compelling advantage that Solaris offers is an integrated common operating environment over multiple architectures. More than 4,000 SPARC programs will be available for the x86



Solaris for x86's GUI offers superb graphics to complement the system's multimedia support. SunSoft has agreed to adopt the Motif desktop manager for future releases to help standardize the Unix platform.

platform. Moreover, DOS 5.0 support and Microsoft Windows 3.1 compatibility are promised soon. SunSoft's Windows Application Binary Interface (WABI), developed with Praxsys Technologies, will let users run Windows applications without Windows. Also in the works for a future x86 version is the native support for multiprocessing and dis-

tributed computing now found on Solaris for the SPARC platform.

Installation, from a CD-ROM and a boot floppy disk, is remarkably simple. The documentation wasn't up to Sun's usual standard, but this should be remedied by the official product release. The extensive on-line documentation system is based on a CD-based Sun product.

Sun has consistently articulated and supported a vision of the future that only fools would dare to sneer at. Though we had only a beta version of the software, it clearly showed that Sun has succeeded in achieving its

goal of a common look and feel between SPARC and Intel platforms. Veteran Solaris users will have to remind themselves that they're sitting at a 486 machine, not at a cleverly disguised SPARCstation. Those in search of a distributed information management system capable of supporting symmetrical processing should have a look. □

Any Unix administrator will appreciate Interactive's one-stop approach to system administration: the character-based sysadm utility. Almost every commonly used system administration task can be accomplished from sysadm; with its clean, complete design, the utility stands out.

Interactive's Unix foundation is SunSoft's port of AT&T's SVR3.2. Although far from the state of the art in Unix research, the operating system has been thoroughly tested and debugged. If you're tired of bleeding all over technology's cutting edge, you will find Interactive's stability a pleasant change of pace. SunSoft hasn't stuck completely to System V Release 3.2 of Unix. Interactive also included some enhancements present in BSD Unix. The most noteworthy of these is sendmail. This mail handler lets you more easily set up multiple-network node connections. Other BSD improvements will be available in Ver-

sion 4.0 of Interactive. This upgrade will let you time events to within milliseconds instead of seconds, assign files names up to 255 characters in length, and create file names with "aliases," which are symbolic links to other files. These enhancements will let SVR3.2 Unix work with the newer SVR4 and BSD file systems.

STICK TO THE BASICS

Interactive's networking facilities are standard TCP/IP and NFS; you'll find no surprises here. The basic system comes with only standard Unix security; a C2-level module is available separately for \$655.

The VP/ix DOS emulator runs well, within limits. While VP/ix can emulate LIM EMS 4.0, it can't supply you with

extended memory. Ordinary DOS character-based programs will run smoothly, but you can forget about anything more elaborate, such as Microsoft Windows 3.1. (Windows 3.0 is supported in Real mode only.) SVR3.2 is a Unix first and doesn't play as nicely with the DOS world

as do the other operating systems.

On the other hand, since Interactive is compatible with SCO Xenix applications, you may not miss DOS. For office work under Unix, SunSoft supplies TEN/PLUS, which combines an easy-to-use file manager with a word processor and an optional e-mail interface. While not the equal of top-flight apps that do the same things, it is easy to use and functional enough for most.

SUITABILITY TO TASK

Interactive Unix

	POOR	FAIR	GOOD	EXCELLENT
Networking	●	●	○	○
DOS Environment	●	○	○	○
GUI Integration	●	●	●	●
Administration	●	●	●	●
Multitasking	●	●	●	○

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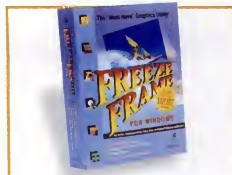
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FACT FILE

Interactive Unix, Version 3.0.1

SunSoft Inc., 2550 Garcia Ave., Mountain View, CA 94043; 800-227-9227, 415-960-3200; fax, 415-336-0362



List price: Basic package for two users, \$495; complete package for unlimited users, \$3,195.

Requires: 386-based PC or better, 4MB RAM (8MB recommended), 120MB hard disk space.

In short: Superior system administration tools, an excellent GUI, and stability are overshadowed by so-so DOS support and lack of non-TCP/IP protocols. Still, this product is good for small, Unix-oriented companies.

486 ON READER SERVICE CARD

For programmers, Interactive comes with two C compilers, a full-fledged context-sensitive editor, and a source-level debugger. Source code is provided for X Window System 11 Release 5, and you also get access to the Motif toolkit.

CALLING ALL SMALL BUSINESSES

Users who want to use a GUI, not write one, will enjoy Visix Software's Looking Glass 2.01, Interactive's bundled GUI desktop manager. Looking Glass's Motif-based user interface, ease of customization, and speed gives us what we want from a GUI: a way of getting more work from the machine without any hassles.

Interactive's documentation is plentiful, and we found the customer-support technicians (available for the price of a call) to be friendly and well-informed.

Interactive may not be as fancy as some of the other systems in this roundup, but then none of the others could run with as little memory and with just a 386SX. Popular Unix and DOS business software ran flawlessly. Interactive is a stable, tried, and tested product that makes an ideal backbone operating system for a small business. While it doesn't have the bells and whistles of UnixWare or SCO Open Desktop, users who are already comfortable with Unix may find it the ideal platform for their homes and offices. But if you're not already sold on Unix, this might not be the place to begin.

The Santa Cruz Operation Inc.

SCO Open Desktop

BY STEVEN J. VAUGHAN-NICHOLS

To many people, Unix on the x86 platform is synonymous with SCO Open Desktop, from The Santa Cruz Operation (SCO). SCO dominates today's tiny x86 Unix market. Whether it will continue to be a big fish in a small pond or grow to be a shark in the larger waters of the 32-bit OS ocean remains to be seen.

Based on the Unix System V Release 3.2 engine (the mainstream Unix of the mid-1980s), Open Desktop has gone its own way and not followed the Unix revisions to SVR4. Casual users won't be able to see the differences, but from a programmer's and system administrator's perspective, Open Desktop is quite different from Unix systems based on the kernels that were developed later.

This is not to say that Open Desktop is a lumbering dinosaur from Unix's past. For instance, the latest version includes a new file system that supports files with long names, just like today's SVR4-based

versions of Unix. Nor does it mean that Open Desktop is isolated from the Unix mainstream. SCO's Unix products take the Tyrannosaurus rex's share of the x86 Unix market, and software vendors almost always support the SCO Unix line.

OBJECT-ORIENTED GUI

Open Desktop's X Window System 11 Release 4, combined with a Motif window manager and an enhanced IXI X.desktop desktop manager (SCO recently acquired IXI), presents users with an excellent interface similar to OS/2's object-oriented Workplace Shell.

Though the execution is not quite on a par with the Workplace Shell or NeXTStep's interface, Open Desktop's icons can be used in an object-oriented fashion. For example, moving an icon from one place to another

moves all the icon's associated files and properties; Open Desktop makes sure that the application can still find its executables and data files without manual intervention.

Of all the systems we reviewed, the Open Desktop interface offers the most consistent match between the GUI and the underlying OS. NeXTStep and Solaris excepted, with the other systems

expert users will find themselves heading for a terminal screen to get work done more quickly. Not with Open Desktop.

APPS RUN DEEP

The base-priced package comes with the usual Unix applications: e-mail, text editors, a calculator, and the like. Users who want more will be quite pleased to discover that there are more native applications

SUITABILITY TO TASK**SCO Open Desktop**

	POOR	Fair	GOOD	EXCELLENT
Networking	●	●	●	●
DOS Environment	●	●	●	●
GUI Integration	●	●	●	●
Administration	●	●	●	●
Multitasking	●	●	●	●



SCO Open Desktop's excellent object-oriented GUI is similar to OS/2's Workplace Shell. Unlike some other systems, expert users won't find themselves bypassing the GUI to work more efficiently.

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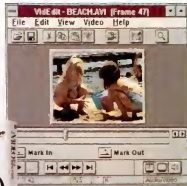
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available for Open Desktop than for any other x86 Unix—more than 3,000. Microsoft Word, for instance, is available in a SCO Unix version. Open Desktop also supports the hundreds of SCO Xenix programs that are still in circulation and still being produced today. One small annoyance, though, is that SCO “presells” some software packages: Open Desktop comes already set up with icons for Microsoft Word and SCO Office Portfolio, though neither comes bundled with the system.

SCO also scores high for making hardware compatibility issues less frustrating. Included with the Open Desktop documentation is a 134-page booklet detailing just what hardware is and isn't compatible with Open Desktop.

Open Desktop comes with the standard array of TCP/IP and NFS network facilities. These include telnet and rlogin, which let you log on to other systems on the network. You can use ftp (file-transfer protocol) to copy files between systems. You can also “mount” disks or directories on other systems, which allows

FACT FILE

SCO Open Desktop, Version 2.0

The Santa Cruz Operation Inc., 425 Encinal St., P.O. Box 1900, Santa Cruz, CA 95061;
800-726-8649, 408-425-7222;
fax, 408-458-4227



List price: Basic package for two users, \$1,295; complete package for unlimited users, \$4,290.

Requires: 386-based PC or better (486 or better recommended), 8MB RAM (12MB recommended), 120MB hard disk space.

In short: Take one box of SCO Open Desktop, add it to your system, and voila!: instant workstation. It offers an excellent GUI, a host of business apps, and support for NetWare and Microsoft LAN Manager networks. You should certainly consider Open Desktop.



ON READER SERVICE CARD

you to access these directories as if they were on your local system. Open Desktop also includes a built-in Microsoft

LAN Manager client, which lets you share disk and peripheral resources across any LAN Manager network.

Another strong suit of Open Desktop is its support for DOS. You can access your DOS files (resident either on floppy disks or as a partition on your hard disk) and manipulate them by using the standard Unix utilities; in other words, your DOS files will be treated as if they were Unix files. You can run DOS 5.0 sessions from Unix merely by typing “dos” at a system prompt or clicking on the DOS icon. You can also run multiple DOS sessions, but be warned that each session will cost you at least 2.5MB of RAM. Version 2.0 supports Microsoft Windows 3.0.

OF ADMINISTRATORS AND DEVELOPERS

In this newest version, the implementation of C2-level security has been tamed a bit; you can now run Open Desktop without fear of finding yourself locked out of the system. Administrators can install Open Desktop from CD-ROM, quarter-inch tape, or floppy disks.

For developers, Open Desktop in-

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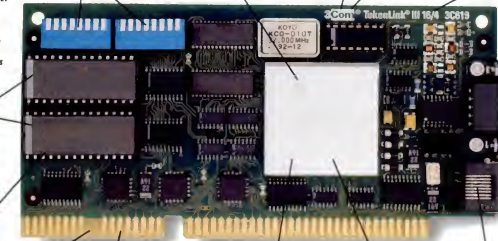
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cludes two C compilers: rcc (the standard Unix AT&T C compiler) and cc (Microsoft's C 6.0 for Unix). In addition to various development utilities (make, Source Code Control System, and lint), the development package includes debuggers and facilities for DOS program development. If you want to cross-develop for

for the first 30 days; after that, a yearly contract will cost you \$895 per year.

VERSION 3.0

Version 3.0, due for release as we went to press, will include support for NetWare and Windows 3.1, including networked Windows applications. It will also have X Window System 11 Release 5, bringing font-server capabilities for downloadable fonts. Those additions, plus Open Desktop's plethora of existing programs, consistent user interface, and superior DOS compatibility, make this OS a choice to consider.

Univel UnixWare

BY MARK WALLACE

For a fledgling product in its first release, UnixWare has an interesting lineage. It's based on USL's Destiny, the same SVR4.2 kernel that Consensus V 4.2 is based on. But UnixWare's ties to its maker are much stronger. Novell and

USL got together to form Univel, which released UnixWare; shortly after the release, Novell bought out USL and now is the sole owner of UnixWare.

As its parentage suggests, UnixWare (available in both personal and networked editions) marries the strengths of DR DOS 6.0, NetWare, and SVR4.2. While Consensus Corp. remained true to SVR4.2 and ships a rather pure version, Univel built upon SVR4.2 to produce an outstanding hybrid NetWare/Unix product.

UnixWare Personal Edition (\$495) can act as a NetWare client, runs DOS 5.0-compatible applications, and supports all types of x86 Unix applications. Univel has also recently decided to include Locus Computing Corp.'s Merge utility, which adds support for Microsoft Windows 3.0 and Standard-mode Windows 3.1. The \$1,299 UnixWare Application Server edition, which we reviewed, additionally includes the traditional Unix networking solutions: NFS and TCP/IP. It also adds a suite of Personal Utilities for power users and system

SCO Open Desktop 3.0 will support NetWare and Windows 3.1, including networked Windows apps.

both Unix and DOS, Open Desktop is the operating system for you.

SCO has refined the presentation of the product as well. The information in the newer documentation is much more accessible, both in style and format. Technical support is available from a variety of forums, including an 800 number and e-mail. Technical support is free only

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administrators, and supports an unlimited number of users.

INSTANT CONNECTIVITY

Communication between NetWare and TCP/IP is the central feature of UnixWare, and the package handles it well.

SUITABILITY TO TASK

UnixWare

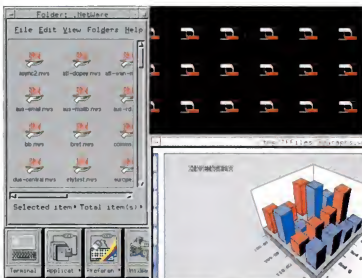
	POOR	FAIR	GOOD	EXCELLENT
Networking	●	●	●	●
DOS Environment	●	●	●	○
GUI Integration	●	●	●	○
Administration	●	●	●	○
Multitasking	●	●	●	○

UnixWare acts as a NetWare client using IPX/SPX out of the box—no special configuration required. While the NetWare connection is worthy of praise, configuring UnixWare to work as part of a TCP/IP network requires a little more work, careful attention to the instructions, and an occasional hurling of an epithet. Still,

within an hour we had connected not only to our NetWare server with IPX/SPX, but also to our SPARCstation II clone running Version 2.1 of Solaris for x86 along with TCP/IP. The end result is a system that can exchange information and applications with all systems.

DOS users can use Novell's virtual terminal programs (included in the package) to exploit Unix's power. Unix users can use NetWare applications from servers on the NetWare network. Some applications, like the included e-mail package, integrate seamlessly across the boundary.

During our testing, UnixWare per-



UnixWare's intuitive and flexible GUI includes easy access to several of Unix's most powerful and attractive features, such as scheduled tasks and automatic program execution.

formed well. It was possible to overload the system (by running multiple local applications while the disk was accessed by remote NFS clients, for instance), but under normal conditions the system hummed like a top. We also found Unix-

YOU CAPTURE THE IMAGES



Unix on Intel


Ware's networking facilities to be fairly robust.

EXTRA OPTIONS, EXTRA VALUE

UnixWare is very configurable. The SVR4.2 desktop GUI, based on X Window System 11 Release 5, is intuitive and flexible. Both Motif and Open Look windows managers are available.

The preferences editor contains 15 categories (color schemes, printers, and the like), each of which can configure at least half a dozen options. While the options could be organized better, Univel's well-thought-out defaults reduce configuration errors. Some changes, though, shouldn't be made. We added a user, then changed that user from the GUI to a character-based log-on. This change couldn't be reversed. Personal Edition ships with two manuals, while Application Server provides ten. The documentation is organized and clear, and UnixWare offers outstanding on-line help.


The GUI includes easy access to several of Unix's most powerful and attractive features, such as scheduling tasks and



FACT FILE

UnixWare


Univel, 2180 Fortune Dr., San Jose, CA
95131; 800-486-4835, 408-729-2300



List price: Basic package for two users, \$249; complete package for unlimited users, \$2,495.

Requires: 386SX-based PC or better, 8MB RAM (12MB recommended), 80MB hard disk space.

In short: If you're serious about migrating to a 32-bit operating system, you need to consider UnixWare. Univel has created a great product that compares very favorably with Windows NT and OS/2. It is nirvana for NetWare users and boasts good application support.



automating program execution. These are powerful, often underrated features of Unix, and they've rarely been this easy to use before. System administration can be done through the GUI as well, or through a character menu-based pro-

gram (sysadm), which is standard on all the SVR4-based systems we reviewed.

THE APPLICATION FRONT

There's a respectable and growing stable of applications available for SVR4-based Unix systems, including WordPerfect, Lotus 1-2-3, FrameMaker, Interleaf, and Informix. UnixWare will also run SCO Xenix, SCO Unix, Interactive Unix, and BSD Unix 4.2 applications.

Unlike the other systems we reviewed, which all run MS-DOS using various emulation and virtual-session capabilities, UnixWare includes DR DOS 6.0 support. Interoperability was fairly painless. We were able to copy files from DOS floppy disks to the Unix file system with the normal DOS COPY command. Most file transfers went smoothly. Our WordPerfect and Lotus 1-2-3 files, for example, moved from DOS to UnixWare and back again without a hitch.

Once UnixWare was properly installed, the system was a pure pleasure to use. We were able to run WordPerfect from the local disk, WordStar

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► SUMMARY OF FEATURES

32-Bit GUI Unix

Products listed in alphabetical order

■ = YES □ = NO

	Consensus V4.2	Dell Unix System V Release 4	Interactive Unix	SCO Open Desktop	UnixWare	NeXTStep for Intel Processors	Solaris for x86
List price:							
Basic package—two users	\$249	\$495	\$495	\$1,295	\$249	\$795	\$795
Basic package—unlimited users	\$695	\$795	\$895	\$2,495	\$495	\$795	Info not available
Complete package—two users	\$795	\$995	\$2,635	\$3,090	\$1,299	\$1,995	Info not available
Complete package—unlimited users	\$1,295	\$1,295	\$2,635	\$4,290	\$2,495	\$1,995	Info not available
Unix kernel	SVR4.2	SVR4.0.4	SVR3.2.3	SCO Unix 4.0.0	SVR4.2	BSD 4.3/Mach/ NeXT	SVR4/ Solaris 2.0

Interface

X Window options supported:							
System 11 Release 4	□	■	■	■	■	□	□
System 11 Release 5	■	■	□	□	■	□	■
Window managers supported:							
Motif	■	■	■	■	■	□	■
Open Look	■	■	□	□	■	□	□
Desktop managers supported:							
Looking Glass	□	□	■	□	□	□	□
X.desktop	□	□	□	■	■	□	□
Other	USL Desktop Manager	None	None	None	USL Desktop Manager	Workspace Manager	OpenWindows
GUI applications included:							
E-mail	■	■	■	■	■	■	■
Text editor	■	■	■	■	■	■	■
End-user help:							
Command-line	■	■	■	■	■	■	■
GUI help engine	■	■	■	■	■	■	■

Administration

Distribution media:							
Tape format	DC-6X	DAT, DC-6X	DAT	DC-6X	QIC-24	N/A	N/A
CD-ROM	□	□	□	■	■	■	■
3.5-inch floppy disk	■	■	■	■	■	■	□
5.25-inch floppy disk	■	■	■	■	□	□	□
Via network	□	■	■	■	■	□	■
C2-level security	■	□	■	■	■	□	■

DOS and Windows Support

DOS support:							
Version	None*	MS-DOS 5.0	MS-DOS 3.3	MS-DOS 5.0	DR-DOS 6.0	None*	MS-DOS 5.0
Supports multiple DOS sessions	N/A	■	■	■	■	N/A	■
Microsoft Windows support:							
Windows 3.0	□*	□	■	■	■	□*	■
Windows 3.1 (standard mode)	□*	□	□	□*	■	□*	■

Network Support

Network protocols supported	TCP/IP	TCP/IP	TCP/IP	TCP/IP	SPX/IPX, TCP/IP	TCP/IP	TCP/IP
Asynchronous network protocols supported	PTP, SLIP	SLIP	PPP, SLIP	PPP, SLIP	None	None	None
Network file systems supported	NFS; RFS (optional)	NFS, RFS	NFS (optional)	NFS, NIS, RFS	NFS	NFS	NFS (optional)

Miscellaneous

C compiler included	■	■	■	■	■	■	■
Binary compatibility:							
SCO Unix	■	■	■	■	■	□	■
SCO Xenix	■	■	■	■	■	□	■
SVR2	■	■	■	■	■	□	■

N/A—Not applicable. The product does not have this feature.

* This feature is scheduled for inclusion by the time this issue goes to press.

Unix Development Tools

by David S. Linthicum

Unix is well-known for the robust, bulletproof development environment it supplies to programmers, a feat due in large part to the unofficial Unix credo: "Build on the work of others." From its first single-user release in the 1960s, Unix has been in constant development and redevelopment, primarily in schools and universities where it first found a home. Over the years some pretty smart people created a number of Unix development tools.

Unix was created for programmers by programmers. The hundreds of utilities and the ways they function by themselves and as a team make the Unix environment extremely programmer friendly. Some of these programs are beginning to look a little old and worn, but they were true innovations, and they provide Unix with its power. Since many of these programs port easily to DOS as well as to other operating systems, many DOS developers may recognize one or more of these utilities. Let's look at a few.

- **awk:** Named after its developers, Aho, Weinberger, and Kernighan, this utility can search a file for lines that match a particular pattern and perform some preprogrammed action on each pattern located.
- **yacc:** Yet Another Compiler Compiler aids in the development of compilers, interpreters, and complex programs. Ever wanted to create your own programming language? Here's your chance. The developer need only sup-

ply yacc with a set of rules describing the custom command language and the actions performed for each command during processing.

- **lex:** Lexical analyzer, used for command processing by developers. The lex utility is compatible with C programs. The developer supplies lex with a set of rules identifying the acceptable commands, and the utility produces routines that execute the lexical analysis of the command lines as submitted.

- **secs:** Source Code Control System provides a library for the management of source code. All changes to program code are identified and maintained by this utility.

- **make:** A utility that enables developers to compile multimodule programs. It recompiles only those modules that have been altered since the last time the program was compiled. This utility saves a tremendous amount of development time. The make utility is distributed with most major DOS- and Unix-based compilers.

THE PAYOFF

The real horsepower of Unix lies not in the utilities provided with the operating system (remember, you can find DOS versions of most of them), but in the way they are implemented from Unix: through the Unix *shell*, Unix's command environment. The features that the shell provides include advanced piping, redirection operations and forking operations, and the ability to run several programs simultane-

ously in the multitasking Unix environment. The shell, which comes in a variety of flavors, passes user commands to the kernel, one at a time. Multiple commands process themselves via *shell scripts*, which are functionally equivalent to DOS batch files but make batch files look like Neanderthal programming in comparison. The shell scripting language, in conjunction with the utilities, can function as a full-blown programming language, able to do everything from advanced relational database operations to interprocess communications.

Off-the-shelf advanced development tools (such as debuggers, object browsers, code formatters, and syntax checkers) are becoming more widely available on Unix platforms and supplement the tools of the standard Unix development system. These newer, more attractive interfaces operate on standard terminals as well as under the X Window and Motif graphical environments. Many of these development tools come from the DOS world.

Symantec Corp., for example, has implemented its Zortech C++ development system on both the DOS and Unix operating systems.

"After going to Disney world, the county fair just never seemed to measure up," a Unix programmer was heard to say when comparing the Unix and DOS development environments. Combined with the power of Unix itself, Unix development tools provide an ideal programming environment. □

in a DR DOS window from the NetWare server, Bradford Business Systems' SpeedEdit (a programmer's editor) from the SPARCstation, and play solitaire in Microsoft Windows 3.0 Real mode in a DR DOS window—all simultaneously! Oh yes—at the same time we were searching for a text file on the UnixWare system from the SPARCstation. If you want cross-system, cross-network integration, look no further than UnixWare.

DOES THE SHOE FIT?

Should you buy UnixWare? For two different types of users, the answer is clearly yes. The first type needs interoperability and transparent communication between NetWare and TCP/IP networks, and also needs the resources to manage such interoperability. The second type of user needs an upgrade path to the more powerful world of Unix applications, but wants to preserve his or her existing in-

vestment in hardware and information.

These two types make up the core of the market segment for which Unix is reaching. More surprising (and pleasing for Unix aficionados), this OS will appeal to those who are looking for a good, solid version of Unix that emphasizes Unix's strengths—communications and power—while redressing some of its failings—ease of use, for example. This just may be the Unix for the masses. □

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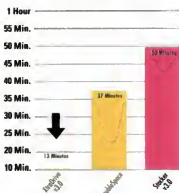
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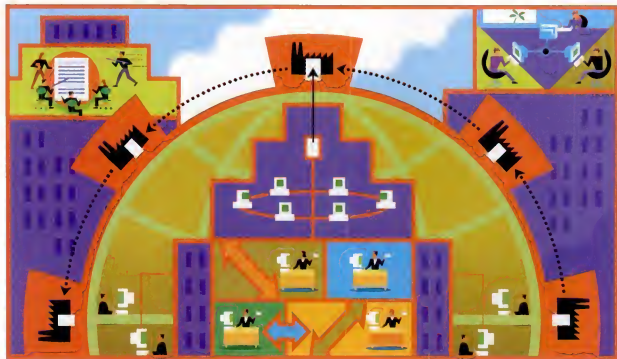
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BEST OF A NEW BREED

Groupware: Are We Ready?



Groupware. Everybody wants it, though no one's quite sure what it is. But the allure of software that can supercharge your group process is powerful. This report looks at the leaders of the PC groupware pack.

Practically the only point of agreement among pundits who discuss groupware (there are lots of them these days) is that it's tough to define. Attempts, such as "software that helps teams work productively together" and "not singleware," don't shed much light. In fact, *groupware* is never likely to have a much more precise meaning than *productivity application* does.

Is groupware real? Yes, it is. Are there intelligent

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by Ted Stevenson

and useful things we can say about it? Yes, there are. But getting the message requires an open mind-set, a certain "willing suspension of disbelief." (Remember trying to explain to someone who had never seen a spreadsheet what an incredibly useful tool it was?) The bottom-line question is, of course, should your business consider taking the groupware "plunge"?

WHAT GROUP? WHY?

Fundamental to arriving at a clear answer is understanding the premise behind the groupware phenomenon: that today's successful business is one that knows how best to leverage the creative energies of workers loosely organized into ad hoc teams. Such teams tend to be related not in the old business model, as superior and subordinate, but as peers in a "flat" organizational structure. Furthermore, they may well be dispersed in different locations rather than gathered under one roof. Organizations that can nimbly create such workgroups to meet the quickly changing needs of today's business climate—and support them well—should have a competitive advantage.

The best way to get a handle on groupware, we decided, is to look at products. But, without a precise definition, which to choose? In the end, our selection criteria for the products we reviewed were loose—like the organization of a workgroup: currently shipping products that run on an Intel-compatible server with DOS and/or Windows clients that, at least to some degree, automate information sharing and/or the management of business processes. Several interesting products that didn't quite meet our criteria (weren't currently shipping, didn't run on Intel-based servers, or weren't in and of themselves groupware, but groupware enablers) we cover in sidebars.

THE E-MAIL CONNECTION

Local area networks—and the connections between them that make wide area networks—are the backbone of groupware. In turn, the software foundation of groupware is electronic mail—in simple terms, the transport of text messages across a LAN. While in our view e-mail isn't groupware *per se*, it is a vehicle for some communications facilities that do

have workgroup implications.

Let's chat. One of these is basic electronic conferencing, often referred to as "chat" capability. Products such as Futurus Team DOS/Windows Combo allow small groups to participate in simultaneous real-time keyboard conversations. (Microsoft Windows for Workgroups, Version 3.1, a workgroup-oriented operating environment, provides a similar capability.) The potential synergy arising from this kind of group interaction raises it, subtly but significantly, above the straight, linear communication process of mail. It's not going to revolutionize any company's strategic information management structure, but it can, in a small way, help tap the workgroup's creativity.

Let's meet. Another basic workgroup support tool often built into or around e-mail is scheduling. For better or worse, most organizations live by meetings, and anyone who's ever had to set one up knows how much time-gobbling drudgery is involved in reconciling all the conflicting personal schedules, finding a meeting place—and doing it all over again when a key participant backs out. If everybody's personal schedule is accessible over the LAN, however, the computer can handle much of the donkey work. Products such as WordPerfect Office 4.0 and, again, Futurus Team build scheduling into the fabric of their e-mail-centered systems. Microsoft Corp., similarly, provides its Schedule+ module free with Microsoft Mail for PC Networks and Windows for Workgroups. (For a fuller discussion of this subject, see "Workgroup Scheduling: Have Your Computer Call My Computer," February 9, 1993.)

Let's not meet. Some recent academic studies have concluded that traditional meetings may not be the most efficient way of handling traditional business problems. One such research project at the University of Arizona led directly to the creation of Ventana Corp. and its commercial "virtual meeting" product, GroupSystems 5. VisionQuest, from Collaborative Technologies Corp., is another respected "meeting support" product.

The idea is that face-to-face meetings tend to be dominated by personalities, not ideas. Since ideas are what meeting organizers are presumably interested in, filtering out personalities, via structured

interactions over a computer network (whether or not the participants are actually in the same room), should promote a speedier and more productive result. Vendors' claims range from a conservative 30 percent reduction in meeting time to overall productivity improvements between 50 and 80 percent!

What products like these provide is methodology (what procedures will we use for gathering ideas? for discussing them? for reaching a consensus?) and structure (how do I rebut that item? reply to that person?). This is unquestionably full-blown groupware and, like most of the breed, requires that users buy into a philosophy—and willingly change their accustomed ways of doing things.

Let's decide. Closely related to virtual meeting packages are the various group decision tools. Like them, products such as CM/1 and Expert Choice offer both methodology and structure to facilitate the decision-making process. Operating in virtual time, they allow discussions to be carried out on an as-available basis by anyone on the network.

SAILING THE INFO SEAS

A very different kind of groupware focuses on managing (accessing, collecting, parsing, sorting, storing, distributing) information. Into this group falls Lotus Notes, a distributed database chameleon with built-in wide area connectivity, automated document routing, and personal e-mail. With these tools, users can easily build data-storage, data-tracking, and open discussion applications that can be connected via phone lines. A classic example (used in Lotus Notes advertising) is a corporate customer-support system, comprising routing of help requests, archives of previously handled problems and solutions, support-staff discussions and messages, and the like.

Beyond being a highly successful product, Lotus Notes is rapidly becoming the nucleus of a whole new groupware development community, as vendors develop Lotus Notes add-ons and products that work in concert with Lotus Notes.

FRUITFUL INFO SHARING

GrapeVINE—an Australian product only beginning to show up in North America—takes a very different ap-

Suitability to Task

PC Magazine's Suitability to Task ratings are designed for evaluating groups of products made to do the same thing—spreadsheets or tax preparation programs, for example. The products that fall under the groupware rubric are quite diverse—designed to do a wide variety of tasks that are loosely related at best. Identifying rigorous task categories for groupware, then, becomes a bit like trying to pin down categories for “personal productivity applications.”

Accordingly, to provide the broadest task-related insights about groupware products, we have chosen to present a loosely defined matrix matching each product against all the types of tasks subsumed under the category.

Rather than serving as “hard” purchase criteria, the ratings presented here are designed to give an overall feel for the shape of each product—strong in these areas, not so strong in those.

In considering groupware, it's especially important to keep in mind the general truth that a product's task-handling

ability is not exactly synonymous with its quality, value, or purpose.

Information sharing. The majority of our task categories fall under this heading. Clearly, collaborative work demands a free exchange of information and can benefit from efficient mechanisms for accessing and moving data.

E-mail is undoubtedly the most ubiquitous technology for moving messages and data files around among members of organizational workgroups; this ability is basic though not essential to groupware. A number of products seek to leverage the utility of basic transport systems by adding on capacities such as BBS or chat-style conferencing, shared contact or phone book databases, and the like.

Information management. The tools in this category are more focused on the organization and facilitation of work processes than on communication. They deal, for instance, with questions of where, why, and how work gets done. They also look at who creates the work or projects, where the documents reside, how far along the process is, where a certain file or message and its attached files are in the process at this moment, and so on.

1—Suited to the task.
2—Exceptionally well suited to the task.
N/A—Not applicable: The product does not perform this task.

BeyondMail for DOS, BeyondMail for Windows	CM/1	Futurus Team DOS/Windows Combo	Keyfile	Lotus Notes	Microsoft Windows for Workgroups	Office.ID	TeamLinks for Windows
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Information Sharing

Messaging (e-mail)	2	1	2	1	1	2	1	1
File transport	2	N/A	1	2	2	2	1	2
Group faxing	1	N/A	2	1	2*	N/A	1	N/A
WAN connections	1*	N/A	1*	1	2	N/A	N/A	1*
Workgroup scheduling	N/A	N/A	2	N/A	N/A	2	N/A	N/A
BBS-style discussion	N/A	2	N/A	N/A	2	N/A	N/A	N/A
Real-time chat	N/A	1	1	N/A	N/A	2	N/A	N/A
Structured-meeting support	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Decision support	N/A	2	N/A	N/A	N/A	1	N/A	N/A
Shared contact database	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A
Shared information database	N/A	N/A	N/A	1	2	N/A	N/A	N/A
Collaborative documents	N/A	N/A	N/A	2	2	1	2	N/A

Information Management

Access control (security)	1	1	1	1	2	N/A	2	1
Data search and retrieval	2	1	N/A	1	1	N/A	1	N/A
Archiving	2	N/A	1	2	N/A	N/A	N/A	N/A
Forms routing and tracking	2	N/A	1	1	2	N/A	2	2
Task routing and tracking	2	N/A	N/A	1	N/A	N/A	2	N/A
Forms creation	2**	N/A	N/A	1	2	N/A	N/A	1
Report creation	N/A	N/A	N/A	1	1	N/A	1	1

* With optional gateway

** With optional forms designer

proach to the issue of group information needs. First, GrapeVINE must be specially tooled for each organization. In the setup process (which requires considerable effort and expertise), topics of interest are identified for each person on the system and classified by interest levels. A complex thesaurus is built to link keywords to topics. GrapeVINE then parses incoming information (which can come from a large number of sources) and routes it to the appropriate persons.

But this is only step one. When recipients read their in-box material, they can perform a much more intelligent evaluation, commenting, reclassifying, and re-routing items as appropriate. Thus a basically automatic information-distribution system efficiently leverages the expertise of individuals for the overall benefit of the organization.

A similar (if less sophisticated) approach to moving information is found in BeyondMail, a rules-based e-mail package offered by Beyond Inc. BeyondMail users can build fairly complex schemes for routing incoming messages to special folders or to other users, based on attributes of the header or message. When rules are used with Beyond's optional forms-building tool, complex work-flow processes can also be designed.

GOING WITH THE FLOW

Work-flow automation software can (and should) do more than move forms around a network, however. Portfolio Technologies' Office.IQ organizes projects into "packages" that contain pointers for all the pertinent data files ("documents") and the applications in which they were created, so that all the tools necessary for completing a task are bundled together.

Another important piece of the work-flow automation picture is the tools and methodologies for building the work-flow "templates" themselves. The picklist programming found in Keyfile Corp.'s Keyfile (reviewed here) is a good example. Predefined connections be-

tween events ("wait for documents," "job done") structure the total task as it moves from workstation to workstation. Keyfile provides enough flexibility in the system that users along the way can modify and refine the process as it progresses.

Moreover, a good work-flow product (Office.IQ, for example) provides progress tracking, so the person overseeing the process can always pinpoint a project's current status and location.

Work flow is not inherently a standalone "application" or function. It can be an ingredient in many other kinds of software tools. (In fact, none of the examples we've discussed here are exclusively devoted to work-flow logistics.) Among the developers working on work-flow systems, Action Technologies (developers of the MHS e-mail transport system) probably has the most experience.

Action has been working behind the scenes for years as an OEM technology supplier, evolving methodologies for work-flow design and tools for industrial-strength work-flow management. The Action Workflow System—comprising the Analyst, a "process engineering" tool, the Application Builder, which turns analyses into work-flow structures, and other tools—is a complete work-flow engine that will be licensed to vendors including DaVinci, LaserData, Lotus, and Verimotion. Applications using Action's technology should be available by the end of the second quarter.

LOOKING AHEAD

Today, groupware stands somewhere between infancy and early childhood. Viable products are here, but businesses are only beginning to embrace them. Small wonder, the products that do exist are a wildly divergent bunch—in their functions, complexity, and cost.

At one end of the scale, a product like Futurus Team offers communications with a workgroup twist at an affordable price (\$649 for five users) and minimal setup and administrative demands. At

the other end, industrial-strength products, such as CM/1 and Keyfile, can cost tens of thousands of dollars to implement, often requiring the services of VARs or other experts for setup and training.

Cost aside, the right groupware product might just be the catalyst that kicks your business into overdrive. Peruse the Suitability to Task matrix and reviews that follow for a survey of the landscape.

Beyond Inc.

BeyondMail for DOS BeyondMail for Windows

BY RON ANDERSON

BeyondMail (for DOS, Release 1.1, and for Windows, Release 1.0), from Beyond, isn't the only PC e-mail package with pretensions to groupware status, but it is the



only one clearly worthy of the designation. BeyondMail, available for MHS or VINES networks, certainly provides DOS and Microsoft Windows users with robust e-mail, but (as the name suggests) it goes significantly further. The *beyond* part of BeyondMail represents end user programming. Mail administrators and end users alike can instruct this mail program to deal with or initiate communications to and from coworkers automatically. At \$995 for ten users, you have never been able to hire such good help so cheaply.

BeyondMail is a state-of-the-art forms-based e-mail package that holds its own even if you ignore its unique programmability. Virtually any feature you can imagine needing for creating, storing, and replying to messages is included in this package. Memo, Phone Message, Request, Meeting, Customer Support, and Transmittal Memo forms are the standard offerings. With the optional BeyondMail Forms Designer package (\$995), you can create any additional forms you may need.

The DOS client utilizes drop-down menus, check boxes, and combo boxes to guide users through form completion.

Our Contributors: TED STEVENSON is an associate editor of *PC Magazine*. LANCE ULANOFF is a staff editor of *PC Magazine*. CRAIG STINSON is a contributing editor to *PC Magazine*. BEN Z. GOTTESMAN is a project leader at PC Magazine Labs. TONY POMILI is an information systems manager with Ziff-Davis Publishing Company. RON ANDERSON, STEVEN C. M. CHEN, JAMES KARNEY, and GREG PASTRICK are frequent contributors to *PC Magazine*.



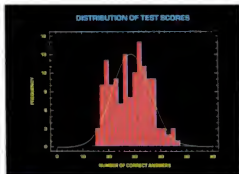
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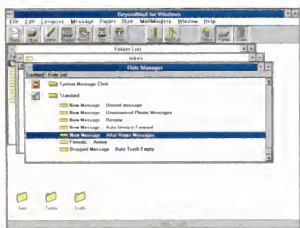
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BeyondMail's Rule Manager makes it easy to keep track of the automatic actions BeyondMail is performing.

The Windows client takes full advantage of the Windows 3.1 environment with drag-and-drop, Object Linking and Embedding (OLE), and Dynamic Data Exchange (DDE). OLE and DDE support are provided in both client and server modes. DDE is accessible through BeyondRules, BeyondMail's end user programming language. Programmable DDE enables you to extend the capabilities of BeyondMail into Windows spreadsheets, databases, and word processors. BeyondRules provides you with the capability to create turnkey solutions for your business information needs.

RULES TO LIVE BY

Beyond's commitment to providing quality end user tools to manage messages is clear. The user guide illustrates rules creation and usage in every chapter. To help users get their feet wet, Beyond provides MailMinders, easy-to-use rules-based utilities that serve as entry-level experiences with BeyondRules.

Four types of MailMinders are available: the Message Clerk, AutoTickle, AutoForward, and While I'm Out. On the basis of criteria you specify by filling in a form, the Message Clerk automatically files messages in various folders when they arrive. If you want to inform a colleague every time you get budget information from someone in accounting, AutoForward will take care of this for you. When you're out of the office for a few hours or days, While I'm Out can automatically reply to mail messages or forward important phone messages to a co-worker.

Ticklers serve as reminders for time-critical events. If a message from your boss prompts you to turn in that special report in two weeks, but you don't need to start working on it until two days before it's due, you would like to be reminded again in 12 days. AutoTickle will move the message to the Tickle folder and, at the appointed time, remind you that your report is due. Once you are familiar with MailMinders, the progression to using the Rule Editor to create your own rules is linear.

ROLLING YOUR OWN

Like MailMinders, the Rule Editor is forms based. Rules are phrased using a WHEN-IF-THEN structure and created by filling in a rule form. The WHEN and IF sections of a rule make generous use of drop-down list boxes to help you define the various events that trigger the rule. The THEN action is more complex, but BeyondMail gives you plenty of help with the numerous actions and functions available, including the ability to paste them into the rule form from a list.

To further illustrate BeyondMail's work-flow management capabilities, let's

create a hypothetical purchase request system. This company's business rules state that middle managers can approve purchases up to \$1,000, but department heads must approve any orders over \$1,000. First, the mail administrator creates a customized purchase request form that automatically calculates extended prices and request totals.

GLOBAL RULE

The House Rule (Beyond's name for a global rule) used to route purchase requests to the appropriate approval authority is created next. The rule includes the following statements: WHEN a purchase request is generated, IF the COMPLETE check box is true, THEN IF TOTAL is less than or equal to \$1,000 SEND to variable MIDDLEMAN, MOVE to INVOICE folder, and produce an ALERT dialog; ELSE SEND to variable DEPARTMENT_HEAD, MOVE to INVOICE folder, and produce an ALERT dialog.

Another rule will forward the approved request to accounting and alert the originator when the purchase is approved. A third rule notifies the originator if the order is not acted on within a week. Additional rules could automate procedures in accounting—including DDE links to a Windows accounting package—and in shipping and receiving.

SYSTEM OVERHEAD

Because BeyondMail is so customizable, administering the system may be more involved than with many competing products. BeyondMail comes with a nice set of tools to help you with administrative tasks, including a fairly straightforward installation routine. A medium-size company that is actively building workflow applications will probably need to dedicate at least one person to administering the mail system and writing House Rules.

Compared with other e-mail offerings, BeyondMail carries a somewhat higher price as the user count increases. While other LAN packages tend to decrease the cost per user as you purchase more licenses, BeyondMail stays pretty close to the \$95 per user cost whether you purchase the 10-user or the 100-user configuration.

► FACT FILE

**BeyondMail for DOS,
Release 1.1**


**BeyondMail for Windows,
Release 1.0**

*Beyond Inc., 38 Sidney St., Cambridge, MA
02139; 800-845-8511, 617-621-0095;
fax, 617-621-0096*

List price: For 10 users, \$995; for 20 users, \$1,995;
for 100 users, \$9,500.

Requires: Server: No RAM. Workstation: 1MB RAM.
For DOS version: 2.5MB hard disk space, DOS 3.1 or
later. For Windows version: 5MB hard disk space,
Microsoft Windows 3.x.

In short: While Beyond's form-based mail system is
excellent when considered on its own, its use of rules-
based technology is what makes it truly innovative and
exciting.

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This Month's Hot Software Downloads

TITLE	FILENAME	DESCRIPTION	LOCATION
ZIPKEY ZIPCODE DATABASE	ZIPKEY.ZIP	A look-up program for zip codes, city names, and states with data on 43,000+ zip codes.	PBSAPPS Lib 9 Business/ Finance
MINES (FOR WINDOWS)	WNMINE.ZIP	Get to the bottom of the screen without getting blown up. Good solitaire logic game. Requires Windows 3.0.	PBSARC Lib 4 Windows Games
DRAFT CHOICE	DRAFTC.ZIP	The easiest amateur CAD system around. Has line, box, freehand drawing, rubber band, scale, rotate, mirror, explode, trim, undo, linear and circular arrays.	PBSAPPS Lib 8 Graphics
WINZIP	WINZIP.ZIP	ZIP file manager that can operate almost all of PKZIP/PKUNZIP's functions, plus LZH and ARC files. Requires Windows 3.0.	PBSAPPS Lib 4 Windows Utilities
CHECKERS (FOR WINDOWS)	WNCHEC.ZIP	For 2 players, or play against the computer. 5 skill levels. A solid game without frills. Requires Windows 3.0.	PBSARC Lib 4 Windows Games
1993 Baseball Schedule	MLSCHD.ZIP	The complete 1993 Major League Baseball Schedule, in dBase, Microsoft Excel, and text format.	AFTERHOURS Forum Lib 6 "Sports of all Sorts"
COOPER PCX PICTURES	PCXCP1.ZIP PCXCP2.ZIP PCXCP3.ZIP	128 .PCX pictures of cute animal and people cartoons for greeting cards, school newsletters, and similar material.	PBSAPPS Lib 8 Graphics
ABOVE AND BEYOND	ABVBND.ZIP	Personal Information Manager with alarm, calendar, text editor, dialer, scheduler and appointment book. Requires Windows 3.x.	PBSAPPS Lib 5 Desktop Tools
ROADWAYS PC	RDWAYS.ZIP	Trip planning program shows highway numbers, major cities, distances, times and calculates trip costs. Requires 384k.	PBSAPPS Lib 5 Desktop Tools
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Every company has different information flow needs—and so does every individual—and requires information to flow in unique ways between workgroups and individuals. A one-size-fits-all approach to this inherent diversity and the changing requirements present in corporations can limit the usefulness of the tools used to automate work flow. The key to BeyondMail's power and potential is the ability to customize how information flow is handled, clear down to the level of the end user. If you're looking for a simple work-flow management application that empowers both administrators and end users, BeyondMail may give you all you need.

Corporate Memory Systems Inc.

CM/1

BY BEN Z. GOTTESMAN

Electronic mail programs have allowed users to escape from the confines of face-to-face meetings. Users don't need to physically gather at the same time and place in order to discuss important topics. Unfortunately, the linear and ephemeral nature of e-mail makes it less than ideal for working out complex, multifaceted problems. But Corporate Memory Systems Inc. (CMSI) has developed CM/1, Version 1.0, a Windows-based hypertext

tool to help with such problems.

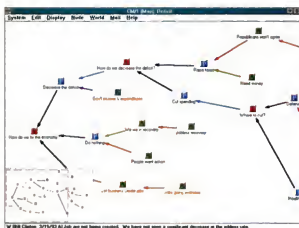
CM/1 is based on the problem-solving methodology known as the Issue-Based Information System (IBIS). In IBIS, problems are explored using Issues, Positions, and Arguments. The highly structured nature of the components keeps the "conversation" focused and helps overcome the dilemma of too many arguments and too much information to keep track of.

CM/1 adds to IBIS a graphic representation of the conversation in which the relationship of each piece to the total picture becomes clearly visible. Discussions created in CM/1 can be saved and reused to prevent repeating prior mistakes or duplicating work.

To begin a discussion, you create a

Map View labeled with the title of the discussion, such as "Sales Automation," "Product Marketing," or "Quality Assurance." Within the map, you create an Issue node. In order to promote discussion, Issues are open-ended questions such as "How should we increase market awareness?" as opposed to far more particular questions such as "Should we advertise on television to increase awareness?"

Participants then offer possible solutions in the form of Position nodes. (To create a node, you simply type the first letter of the node type, such as *P* for *Position*, and type the label. After the node is created, click the right mouse button and drag the cursor from the Position to the Issue to create a "Responds To" link.) Arguments are added in a similar fashion. An Argument node can Support or Object To a Position, or it can Specialize (further explain or refine) an Argument. New Issues may be raised that expand or challenge previous Issues, Positions, or Arguments. Type a letter, type a label, and drag the cursor; once you've mastered that, you're well on your way to mastering CM/1.



CM/1 encourages in-depth analysis of issues. Unread messages are indicated in red.

The graphical discussion tree you create with CM/1 allows far more in-depth discussion than the electronic mail's linear format. At any time, you can add a new Issue, Position, or Argument to any previous node, regardless of whether the original node was entered yesterday or two months prior. Other participants can immediately spot added nodes because their text appears in red to indicate the nodes have not yet been read. And by observing the connections and pointers between these and other nodes, users are quickly reminded of the earlier discussions to which the new nodes respond. Try that in your electronic mail program.

When you open up a Map View, you will see as many nodes as can fit in the window. The higher the resolution you run Windows in, the more of the discussion you will be able to see at a glance. In the lower-left-hand corner is a miniaturized Full Map view. This lets you quickly see *all* the branches that have been spawned from the Issue. To zoom in on portions of the map, you can drag an outline box representing the screen within the Full Map view. Unfortunately, the program does not have scroll bars to move around the map. CMSI has indicated that they will be added in an upcoming release.

IN-DEPTH DISCUSSION

In addition to Issue, Position, and Argument nodes, CM/1 also supports Reference, Notes, and Decision nodes. Reference nodes allow links to external documents—a spreadsheet that backs up your Argument, for example. Reference

FACT FILE


CM/1, Version 1.0

Corporate Memory Systems Inc.,
8920 Business Park Dr., Austin, TX 78759;
512-795-9999; fax, 512-794-5921

List price: For 1 user, \$1,500; for 200 users, \$780.

Requires: Server 1.5MB hard disk space. Novell's NetWare recommended. Workstation. 4MB RAM, any DOS-based network, Microsoft Windows 3.0 or later. Super VGA recommended.

In short: Corporate Memory Systems' CM/1, Version 1.0, provides organizations with a means of capturing the group thought processes that lead up to decisions. CM/1 is especially suited for complex decision-making and long-ranging discussions. By combining graphics and hypertext, it breaks out of the linear, chronological model of electronic mail. Its easy-to-use interface encourages thorough exploration of issues.

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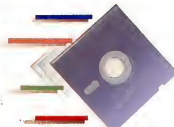
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CIRCLE 120 ON READER SERVICE CARD

Which Group(ware) Are You?

We looked at nine products, and we found almost as many different types of work-group situations. If groupware is a pie, then each product tackles a single slice. Of course, there's a certain degree of overlap, and not all pieces are equal. Here's a look at the slices and the products that best fit them.

THE SMALL GROUP

Keyfile, Version 2.0
Office.IQ

This is a group of four or five tightly knit coworkers who tend to interact heavily on projects. (The groups are not necessarily everlasting; they may dissolve and be re-created on a per-project basis.) One member may cre-

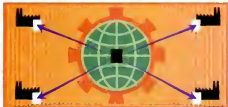


ate, copy, or scan an initial set of files or documents. The other team members enhance, adjust, suggest changes to, and generally refocus the work. All collaborative notes can appear on one document; the document can have some tracking provision to log whose changes came first, second, third, and so forth. These comments and changes can then be incorporated into the finished project.

THE PLANETARY GROUP

Lotus Notes, Release 2.1A

With offices all over the world, a company can have a hard time keeping track of all its wide-reaching information. For example, salespeople in every location need to know whether the account for the Boolex Company, with offices in America and Canada, shows that it has agreed to buy widgets for all



its locations. A self-replicating database with some application development tools could be the perfect answer. With it, up-to-date customer and account histories would be available at all locations, and with a sales-order tracking tool built in the application development environment, all invoices are automatically filled and copied to the product distribution center.

THE DECISION-MAKING GROUP

CM/I, Version 1.0

OPEC oil ministers regularly meet to decide whether they should slow production to hike up oil prices. The problem is, they always have to meet face to face and discuss the same issues over and over again—every year.

What they need is a tool that will let them discuss the issues involved



from their individual locations (over a proprietary leased-line network) and yet remember past discussions, arguments, and conclusions to save time.

THE WORN-SNEAKERS GROUP

BeyondMail for DOS, Release 1.1
BeyondMail for Windows, Release 1.0
Futurus Team DOS/Windows Combo
TeamLinks for Windows, Version 1.1
WordPerfect Office 4.0

The workers in a small business environment are constantly hand delivering the goods: products, invoices, messages, and even appointment notices from one desk to another for approval



and changes. And to make matters worse, they can't afford secretaries. So when they're out of the office, work just piles up on their desks; nothing moves. They need to automate the flow of work and messaging from one desk to another (in their absence and while they're at work) in a logical way that can be saved and changed as necessary. And frankly, they need to cut back on a few messenger people who run up and down between floors.

THE "WHY DO WE NEED A SERVER?" GROUP

Microsoft Windows for Workgroups, Version 3.1

Workers in situations like this have something in common with the Small Group and the Worn-Sneakers Group, but they don't want the expense, rigidity, and maintenance of a server-based file system. For small groups that work closely together, one solution is to create ad hoc peer-to-peer relationships.



These folks just want to perform some scheduling, send some e-mail, and have the ability to log electronically on to each other's hard disk and copy or work on the files they need to.

—Lance Ulanoff

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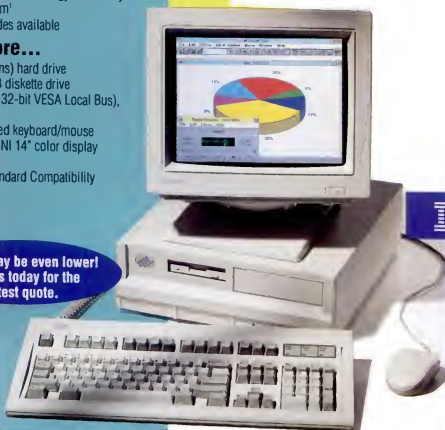
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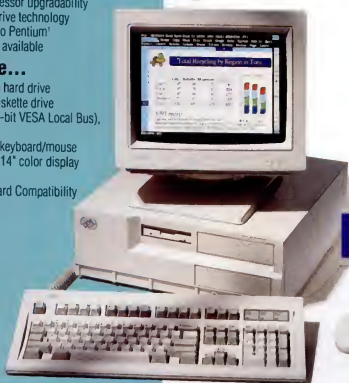
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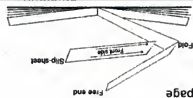
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 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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2. Insert this sheet with
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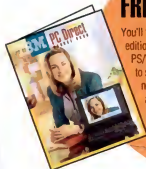
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nodes are ideally suited for, but cannot yet take advantage of, Object Linking and Embedding (OLE) or Dynamic Data Exchange (DDE). Notes nodes can contain text that simply gives more information about a topic. Decision nodes show that an issue has been resolved and can also show the nodes that led up to the decision.

If a discussion becomes unwieldy, you can collapse portions of it into Map Views that can be embedded within the main Map Views. Embedding maps is also useful for referring back to prior conversations.

As with any really new software, CM/1 has a rough edge or two that could stand to be smoothed. For example, it occasionally strays from accepted Windows conventions. Case in point: While the program is generally quite easy to use, each time you open up a new view, the program opens a new session of the application rather than opening a new window within a main shell. As a result, there are no controls to arrange open views neatly. Access the Windows Task Manager (Ctrl-Esc) to list your open applications, and you'll find it cluttered with every CM/1 view you have open.

There are other minor quirks. For instance, CM/1 replaces the traditional Windows File menu with a menu titled System (which includes print and search commands, as well as some window controls). Also, you cannot print the full text of a map directly from CM/1. The Print Text option is really an export option that creates an RTF (Rich Text Format) or an ASCII outline file. And the Print Map option lets you print only to PostScript-compatible printers.

BROAD TALK

CM/1 is very capable at handling large, wide-reaching discussions. Yet it currently doesn't support any form of remote access. So if you're on the road, don't expect to be in on a CM/1 discussion.

CM/1 runs on any PC network. NetWare users can take advantage of the Btrieve NetWare Loadable Module (NLM) record manager to speed up the program significantly. CMSI has Unix and Macintosh versions in the works.

CM/1 is rather expensive. A single-

user version of the program costs \$1,500. Multiuser licenses can lower the program price to \$780 per user for 200 users. CMSI also provides consulting services to help you get up and running quicker.

CMSI is a small company and has thus chosen to market CM/1 initially toward carefully selected industries (such as defense, utilities, pharmaceuticals, aerospace, and telecommunications) that deal with extremely complex issues over long periods of time. But the product is so simple to use that it can become an invaluable tool for any group or individual who must explore complex issues with unknown answers.

Keyfile Corp.

Keyfile

BY GREG PASTRICK

As a comprehensive document and workflow management tool, with robust image- and document-annotation features built around a customizable set of object-oriented tools, Keyfile 2.0, from Keyfile Corp., is an ambitious piece of programming. By breaking down the barriers between paper and electronic data, Keyfile brings you an all-in-one way to manage documents and files across a group.

You should understand, up front, that Keyfile is object-oriented programming—big time. It uses a desktop metaphor to organize documents and workflow. Documents are stored in filing cabinets or folders and are manipulated with fully drag-and-droppable tool objects. Such features as the object-oriented interface, keyword-indexed document storage, a suite of application file viewers, and TIFF-it (a nifty document-to-image conversion technology) all contribute to Keyfile's power and versatility.

The product comes in two multiuser versions and a Personal Edition. The full-blown Enterprise Edition (for large workgroups, \$4,995 plus \$995 per workstation) requires an OS/2-based server. We looked at the Workgroup Edition (\$2,995, maximum of five users), which runs off a Windows 3.x server and has all the document-handling features of the Enterprise Edition.

In addition to the document server and (up to) five connected workstations,

a Workgroup Edition installation has a server for each peripheral (such as printer, scanner, fax, and so forth) that will be used to receive or distribute documents.

OBJECT KEY

The Keyfile desktop comes equipped with a powerful collection of document-



and image-handling tools, including objects for launching applications, accessing hardware, creating new objects, and automating workflow tasks. Also provided are tools for trashing and shredding files and customizing tools to use with Keyfile's KOALA scripting language.

Since, as mentioned, Keyfile treats everything as objects, all of Window's drag-and-drop rules apply. Thus, performing an action in Keyfile usually requires little more than dragging a document icon and dropping it on top of another icon. To share a financial report with a marketing group in the Keyfile milieu, for example, you simply grab the file icon and drop it on the labeled file cabinet icon set up for access by all members of that group. Similarly, to print or fax a letter, you grab the

▶ FACT FILE
Keyfile, Version 2.0 Keyfile Corp., 22 Cotton Rd., Nashua, NH 03063; 603-883-3800; fax, 603-889-9259
List price: Workgroup Edition, \$2,995. Advanced peripheral server, \$995. MHS communication server, \$995. Optical disk support, \$995; 5-slot optical disk support, \$1,995; 11-slot optical disk support, \$2,995.
Requires: Server: 16MB RAM for dedicated servers recommended. Workstation: 386-based PC or better, 8MB RAM, VGA display subsystem, DOS 5.0, Microsoft Windows 3.1.
In short: An object-oriented interface, a suite of application file viewers, and its TIFF-it rasterization technology are some of the feature highlights that make Keyfile a strongly integrated document-management package. The system, however, requires a good measure of technical hand-holding and support to set up and use its tools to its greatest advantage.
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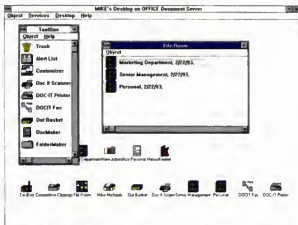
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On the Keyfile desktop, everything (including the application itself) is an object.

icon depicting it and drop it on the icons representing the attached fax or printer hardware.

Users share not only documents but the homemade, task-oriented applications, or objects, that help manage them. For example, once a successful draft-approval-routing work flow has been created it can become a prototype, easily accessed and modified for similar tasks.

GROUP TOOLS

Among the Keyfile features essential to sharing information is TIFF-it. TIFF-it creates a graphical image of a data file (regardless of file type), essentially an electronic printed page. It is this electronic page that is circulated amongst the workgroup for annotation and comment, not the original data file. Users can type or draw freely on the TIFF-it image, while the integrity of the original document is maintained. If you've ever marked up a report, it's not much different; TIFF-it just lets you do it electronically. This image remains attached to the original file as it is routed from user to user. One person, usually the document originator, ultimately integrates the TIFF-it comments into original file.

A special type of comment, known as a TypeMATIC field, allows the entry of structured, formatted text on top of the TIFF-it image. Users can even create their own forms, such as a fax cover sheet, with these tools. Future versions of Keyfile will allow Windows audio format (*.WAV) file attachments and OLE.

The system's ad hoc and structured document-routing capabilities are pri-

marily defined by the JobMaker tool. JobMaker's approach to routing relies on building a series of basic steps or a sequence of events that must be completed or addressed before the next step is triggered. These include routing for information only, defined response, wait for documents, and job done.

JobMaker eases the process of creating routing structures with a series of dialog boxes used to build the details and define the attributes for each step. A typical job might require defined responses to an attached document or image from a list of users in a given workgroup. As each user responds to the document, it may then be passed to the next participant in the work flow. Users may further refine the flow by adding due dates, alerts for overdue work, and notifications to the job originator.

On the hardware side, Keyfile supports a solid list of fax, scanning, printing, and storage devices. Among them is Okidata's DOC-IT. Okidata and Keyfile worked together to develop DOC-IT drivers for Keyfile, and the device's built-in printer, scanner, and fax (as well as copier) make it an especially apt companion for Keyfile.

Don't let the shrink wrap on the box fool you. Once set up, the accessibility of Keyfile's tools and the power of its storage and peripheral-server functions make this a robust package. But the burden of making it a practical system for the group falls on the system integrators who initially set it up and the administrator who sees that it doesn't fall down.

The company recommends a NetBIOS-compatible Ethernet network for best results, and though the installation and initialization of the system are totally automated, setup and maintenance of the dedicated document and peripheral servers require an experienced hand. Setting up individual and group security rights, privileges, and protections is neither difficult nor time consuming, but it does require a clear understanding of the levels of access required by groups and individuals. Keyfile recommends high security

on personal folders, with liberal access to group folders, filing cabinets, and tools.

Keyfile's documentation won't prove to be of much help for the novice user attempting to handle these system setup tasks. The product is typically installed by VARs or system integrators, and that's not likely to change any time soon.

Pushing document management and work-flow automation into the mainstream is a daunting task, even at the small-group level. The capital investment to acquire workstations with enough memory and processing power to do a program like Keyfile justice is considerable, and the necessary peripherals are no less a significant investment. The need for an efficient and accessible small work group system is there, however, and Keyfile has a serious product and system to meet the challenge.

Lotus Development Corp.

Lotus Notes

BY TONY POMPILI

It's a paradox. While it's far and away the best-known and most widely used groupware product in the PC world (some peo-

FACT FILE

Lotus Notes, Release 2.1A

Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 617-577-8500; fax, 617-693-1299

List price: \$495 per node.

Requires: Server: 386-based PC or better, 8MB RAM, at least 100MB hard disk space. Server operating system: OS/2 Standard Edition or Extended Edition 1.2 or 1.3 or Pathworks 1.1 for OS/2. Server network software: NetWare Requester for OS/2 1.1, 1.2, or 1.3; OS/2 EE 1.2 or 1.3 (with LAN Services); VINES 4.10, or Pathworks 1.1 for OS/2. Workstation: 286-based PC or better, 4MB RAM, 40MB hard disk space, Microsoft Windows 3.0 or 3.1 (protected mode only), Pathworks. Workstation network software: NetWare 2.15; IBM LAN Server; Microsoft LAN Manager 2.0; VINES 4.10; or Pathworks 4.0 for DOS.

In short: A general-purpose communications product, Lotus Notes combines full-text flat-file database capabilities with multisite e-mail for building company-wide multisite information-routing applications.

ON READER SERVICE CARD

So, what is Notes? A simple, one-dimensional answer: Notes is a database. Additional dimensions: It's a *distributed multiuser* database. (The information lives simultaneously in several places and can be accessed both over a LAN and via remote dial-up.) It is a *multiformat* database. (Different database templates are provided for tracking, reference, discussion, and information "broadcasting.") Further, Notes incorporates message transport (e-mail) and a programming language with functions to control everything from string manipulation to data validation to document routing. All of this is built on top of technology (the "engine") that allows Notes to operate over virtually unlimited geographical areas in something approaching real time.

In a typical Notes installation, copies of the *database* (the aggregate of all the organization's "publicly accessible" and private mail databases) are placed on geographically separate database servers—say, one each in the Boston, Chicago, Seattle, and Tulsa offices—that communicate via dial-up phone lines. Notes keeps all of these copies synchronized and up to date through periodic "replication," a key element of the Notes engine; at regular intervals (say, hourly), Notes compares these databases copies, marking documents that have been added, deleted, or modified. Where it

The net result of all this is that all users on the system, whether at their desks or on the road with their laptops, have concurrent access to the same information (albeit with some time lag).

Fortunately, the complex underlying communications architecture that drives Notes is totally transparent to users. What they see is the client interface or front end; what they interact with is *applications* (task-specific databases, created by anyone from end users to professional programmers).

the like), but with Notes, data could be input locally at each server and automatically consolidated via replication. Also, a Notes application could easily automate further details, such as routing reports to, say, the sales manager or the credit department, depending on specified conditions.

The Notes engine takes care of moving documents and messages automati-



cally among databases, on the same server, or at a server on the other side of the world. A key resource in this process is the Notes Name and Address Book, which contains entries for all of the databases in the network, including individual mailboxes.

Finding and presenting information are two of Notes' weaker areas. The package does provide a customizable browse format called Views, which allows developers to slice up documents into convenient displays focused on selected information. Our sales-tracking system, for example, might have a View showing filled orders and another showing pending orders.

The package lacks the kinds of report-



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Building the Perfect Office

by Lance Ulanoff

With WordPerfect Office 4.0, WordPerfect Corp. promises to give "a whole new meaning to e-mail" (that is, "groupware"). We took a long hard look at an early beta version (at this writing, Office was scheduled to ship in late spring). Certainly, it leaps ahead of its own 3.1 predecessor. Still, in spite of the seamless integration of rules, routing, and group scheduling (in a rich suite of office tools) and its cross-platform and wide area network functionality, Office 4.0 may just fall on the borderline of groupware.

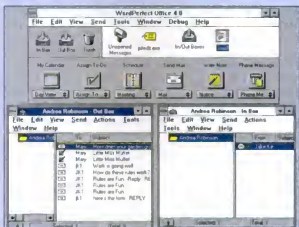
Even so, Office 4.0 appears to have the groundwork in place for even greater strides over the groupware line. To wit, WordPerfect will release Office on multiple platforms—DOS, Windows, and Macintosh—simultaneously; Unix should follow sometime thereafter. In addition to total cross-platform functionality, Office will also have an underlying WAN substructure for tying together larger offices across servers and post offices. Additionally, an asynch gateway will ship with Office, and gateways for SNADS and PROFS will be available approximately three months after the first Office shipment. Along with a fax/prINTER gateway, connections for popular mail transport systems such as Novell MHS, SMTP, and X.400 will also be available, all at additional cost. According to WordPerfect, gateways for AT&T EasyLink, MCI Mail, and Verimemo Memo should be available sometime after 4.0 ships.

GROUPABILITY

Among the clearest signals of Office's groupware intentions are new workflow-control abilities. Office 4.0 adroitly ties a simple routing engine to its e-mail system. By simply selecting a list of addresses, users will be able to create a simple routing slip for a message, task, or appointment. If there is an attachment, users could open it, work on the

file, then check the completed box, and the message (and attachment) will automatically move on to the next addresses on the list. Users will also be able to save routing slips by adding the list of users to their personal groups as a "Route Group."

Inform (WordPerfect's new forms-building product, which should be shipping by the time you read this) would appear the perfect companion product



The main window in WordPerfect Office 4.0's Windows client will feature a "Shelf" where users can save custom and proxy views.

for Office. WordPerfect seems to agree. For now, most of the integration between the two products is handled by Inform, and how that integration will eventually manifest itself in Office has not yet been decided.

AUTOMATE IT

The inclusion of rules will help Office act as the secretary so few of us have. They can be designed to act on e-mail according to user-specified instructions. Included in these rules are numerous variables on the type of incoming or outgoing mail, such as sender, type of attachment, sender priority, and others. Under an action box, the user sets what series of actions will be taken on a message, including forwarding, saving to a message folder, and copying. Office 4.0 will even offer in its list of actions the ability to launch an application.

Office will also search inside message text to complete a rule. For example, if the word *bills* is a keyword for a rule, any message including that word will be acted upon accordingly. Rules can be invoked or disabled at any time.

MORE MAIL

Mail message creation and reception has also been enriched in Office 4.0. Additions include spell-checking, additional attachment viewers, and an out-box that tracks tasks, appointments, and messages. To check the status of mail or an RSVP for an appointment, users simply double-click on the item in the out-box, opening an information screen that includes a complete list of user activity on the message. But the one feature that regularly brings a sly grin to most faces is the ability to retrieve unopened mail messages sent by you to someone else's mailbox. Just imagine having sent, in a fit

of pique, a caustic message to your boss. The feeling passes, but the message is still out there. If a look at your in-box shows the message you sent as unread, you're in luck; you just retrieve it.

REMODELING OFFICE

Office's DOS and Windows interfaces are similar in some respects. The Windows interface has been redesigned with an innovative all-in-one Main Window. Along with in- and out-box icons, it contains buttons for the calendar, memos, phone messages, mail creation, appointments, to-do, and more. An initially empty window area in the upper-right-hand section of this shallow box contains Office's new "Shelf" feature, where users will be able to save custom views, often-launched apps, and the schedules, mail, or calendar views of others.

While duplicating almost all of the features of the Windows client, the DOS client is not overly graphical (read "not GUI-DOS"). Nevertheless, it does have windows with scroll bars that support resizing and minimizing.

Every Office 4.0 screen or window is known as a view. But what if you don't like Office's calendar or mail message window? One answer here may be to roll your own. In addition to having a cadre of premade views, WordPerfect has included a View Editor so that users can create and save their own custom views.

DELEGATOR

Executives usually have assistants, and those assistants often handle their mail, messages, and schedules. With its multilayered security options and Proxy feature, Office will be well prepared for this type of working situation. Using an Access List, users will be able to set individual and group read and write privileges for each part of their Office suite. Providing they have the right, they could "proxy" another user and view the other's mail, schedule, or any other part of his or her Office suite. For example, an assistant could proxy a superior's mail window, drag a small icon from the window's upper-left-hand corner onto Office's Shelf, name it Boss's Mail, and then view it alongside his own mail window at any time.

Proxying also comes into play when scheduling a group appointment. Users could invoke proxy (if they have the right) to view other's calendars and schedules, have Office automatically search for free time among a list of users, or use the free-and-busy-times grid to select the best time for the meeting.

Office probably won't be the perfect word for groupware. But for WordPerfect shops that will gain added integration between their existing WordPerfect apps, Office 4.0 will probably make the office a little "suite-er." □

ing features we expect from a "true" database. As a workaround, you can do basic totaling in Views, then print your Views to produce rudimentary reports. Notes, Release 2.1A, includes a rudimentary text search feature, but Release 3.0 will offer full-text searching through indexing.

THE BOTTOM LINE

Lotus asks \$495 for each server or workstation node (and offers volume discounts). This is not Notes' full cost, however. Server setup (on OS/2 file servers, remember) is complex and likely to require technical assistance. Once set up, servers need to be maintained, as do the applications, databases, and Address Book. And Lotus Notes applications often need to be custom created with tools provided. So in addition to hardware and software, expect also to add people resources.

On the surface, Notes 2.1A appears unimpressive, almost kludgy. Its interface is far from sexy, its search and reporting tools primitive. Beneath the surface, however, it is powerful and robust. And it is likely to remain a dominant force in groupware for a long time to come.

Portfolio Technologies Inc.

Office.IQ

BY JAMES KARNEY

Office.IQ makes using Windows a bit like working in a virtual office. Instead of running applications and loading files, you deal with projects. It offers tools for collecting related files into one document, called a *work package*. You can send the entire collection to other users, complete with electronic notes. Sold in groups of five at \$1,995, this first offering from Portfolio Technologies provides workflow routing, custom search procedures, and extended filenames that make it easy to locate and distribute information as well as see who is using it. Project managers can use Office.IQ to control access to information and track completion of milestones.

Office.IQ provides an object-oriented desktop for each user where work packages are stored in icons that look like

folders. Files can be grouped in these folders or displayed as individual elements on the desktop. Clicking on a folder opens a window displaying its contents. Clicking on a file-related icon loads the file with its parent application. The program uses the Windows file-type associations.

A VIRTUAL WORKSPACE

Using the Office.IQ environment is much like sitting at a desk. It provides an In/Out Box for sending and receiving objects that can include work packages, faxes, notes from other users, and even multimedia objects. A Trash Can icon is used to destroy objects. The vertical sidebar on the right-hand side of the program window is used to create objects and new work packages. You first drag a folder template onto the desktop, then drag task-related objects into it. These can include files from almost any DOS or Windows application.

You can create multiple desktops, each tailored to a specific task or project. Clicking on a box at the base of the sidebar lets you switch from one desktop to



FACT FILE

Office.IQ

Portfolio Technologies Inc., 5600 Mowry School Rd., #100, Newark, CA 94560; 510-226-5600; fax, 510-226-8182

List price: For 5 users, \$1,995; for 100 users, \$13,965.

Requires: Server: 4MB RAM, 40MB hard disk space, NetWare 3.11 or later. Workstation: 4MB RAM, DOS 3.3 or later, Microsoft Windows 3.1, 8MB swap file

In short: Office IQ's object-oriented approach to workflow management offers workgroups a simple-to-use system that handles document routing, controlled access to files, and document management by using easily defined templates. It's a great tool for project managers who need to control access to information and track completion of milestones. This first release is a little rough around the edges, but it is easy to install and operate. While it may not suit those needing tight controls, it will satisfy many less rigorous users.



ON READER SERVICE CARD

Open Windows for Workgroups

by Craig Stinson

Unlike many of the other programs reviewed here that attempt to put the power of groupware into the hands of the end user, Microsoft Corp.'s Microsoft Windows for Workgroups 3.1 network operating system places the power of groupware development into the end user's hands. By extending the basic Windows operating environment through the addition of Network Dynamic Data Exchange (NetDDE) and the implementation of the Simple Messaging Application Programming Interface (Simple API), Windows for Workgroups provides the tools to enable users in ad hoc workgroups to develop their own groupware applications.

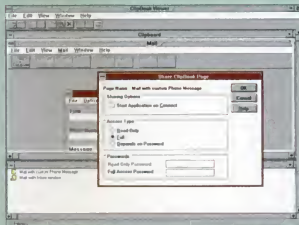
On the surface, Windows for Workgroups is much like other peer-to-peer LAN operating systems, such as Artisoft's LANtastic and Novell's NetWare Lite. The program easily enables users to share storage devices such as hard disks and CD-ROMs and peripherals such as printers and modems.

Windows for Workgroups also comes with starter apps that demonstrate the power of connectivity. These include Mail, a single-post-office version of Microsoft's e-mail program; Schedule +, an agenda manager and meeting planner that works hand in glove with Mail; Chat, a utility that lets users type directly onto others' screens; and Network Hearts, a rendition of the classic card game playable by up to four workgroup members.

Windows for Workgroups offers enhancements over single-user Windows designed to simplify the communal use of data objects, files, and hardware. File Manager, for example, now includes a command that lets you make any local directory available to others and a second command that rescinds the privilege. Print Manager has similar commands for sharing printing resources. And the Clipboard has not only a new look but a new name as well. Called

Clipbook Viewer, the enhanced utility finally allows users to create disk-stored serapbooks of objects that are cut or copied to the Clipboard. More important from the standpoint of collaborative work, it also lets you make any such object available for shared use.

With File Manager, Print Manager, and Clipbook Viewer, the person "owning" the resource can restrict shared access via a password. And for files and



To initiate a NetDDE link, data must be copied to the Clipboard, then pasted into the server's local Clipbook.

Clipbook objects, the sharing may optionally be made read-only.

More subtle group-supporting enhancements appear in the common dialog boxes that many Windows applications now use. Microsoft's COMM.DLL now includes a Network button, making it easy for users to read remote files without first going through File Manager. If you're not logged on to the network when you try to grab a remote file, the enhanced DLL will even offer to log you on, saving you a trip to Control Panel.

Mail and Schedule + are highly serviceable applications. Along with Windows' new file-sharing services, they will bring joy to users who are now playing phone tag and flipping disks over office partitions. Lying directly behind the veil are two powerful software engines: NetDDE and Simple API. These pro-

gramming interfaces will enable commercial in-house developers and end users (albeit power users) to generate more elaborate groupware products than Microsoft itself has yet provided.

Windows users have long been able to take advantage of DDE (Dynamic Data Exchange), which provides dynamic links between applications. NetDDE extends this capability by enabling the user to launch the linked application (known as the DDE server) even if it resides on another user's system. On the most basic level, this allows for the simple creation of collaborative documents. One user can work on the master document while others update embedded spreadsheets, graphs, or artwork.

NetDDE can be taken a step further, however. By enabling a user to launch applications that reside on other systems in the workgroup, processes can be developed

that take advantage of special hardware on other systems, such as a high-speed modem or 3270 gateway. Tasks can even be created that distribute processing of complex data across multiple systems.

NetDDE can be accessed from any Windows application that currently supports standard DDE calls, such as the macro languages in Microsoft Word for Windows and Microsoft Excel and programming languages such as Microsoft Visual Basic. Microsoft has built security features into NetDDE similar to those found in File Manager and Print Manager.

The manual interface to NetDDE is the Clipbook Viewer. If a data object arrives on your clipboard via an application that supports DDE, you may paste-link that object into a DDE-supporting client program and thereby effect a permanent link to the data source.

The Network Hearts game and Chat applet show how NetDDE can effectively drive the same application on two or more workstations simultaneously.

MAIL ENABLED

Simple MAPI is a subset of Microsoft's forthcoming Mail Applications Programming Interface that includes a dozen functions for sending, retrieving, and managing mail. The Windows for Workgroups Mail program uses Simple MAPI to implement a rudimentary workgroup communications system whereby users can send, receive, reply to, and forward messages, with or without attached files. Other Microsoft applications (Excel, Schedule +, and Word for Windows), as well as third-party applications such as Symantec Corp.'s Norton Desktop for Windows, also support Simple MAPI and immediately become "mail enabled" when Windows for Workgroups is installed.

The 12 Simple MAPI functions can be found in the MAPI.DLL Dynamic Link Library. Many Windows applications can access DLLs through their macro languages. For instance, a user savvy in Excel programming could create a mail-enabled expense-tracking spreadsheet that will notify group members if it has not received their latest expense data or if their expenditures are over a certain threshold.

The foundation for all of this is in the Windows for Workgroups box. The elaboration is back in the user's hands. □

► FACT FILE

Microsoft Windows for Workgroups, Version 3.1

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080; fax, 206-936-7319.

List price: For one user, \$249.95.

Requires: 386SX-based PC or better, 3MB RAM (4MB recommended), 9.5MB hard disk space (14.5MB recommended), VGA or better, DOS 3.3 or later.

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another. For a report, the desktop might include several folders related to the project.

A NEW FACE

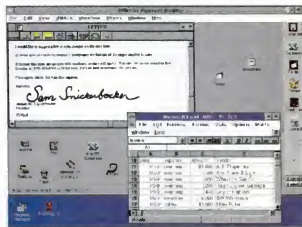
The Office.IQ interface took a little bit of getting used to. Those comfortable with Windows may find the object-oriented approach a bit awkward at first, but grouping your work by project makes it easier to get things organized. Finding a file and controlling access are a lot easier than with DOS or the Windows File Manager. Information about an object (called *attributes*), including a 32-character name, subject, object type, title, who created it, a reference number, and keywords, are all stored in the program's database. You can browse through folders or execute a search using any combination of attributes. We were able to locate documents related to a specific project and author with ease. One shortcoming is the lack of any way to enforce what attributes must be filled in. The only mandatory field is the filename, so you may not be able to make a complete search using a key attribute.

Access to files can be limited to individual users or defined groups by whoever initiates the work package or by the system administrator. You can set up as many groups as you wish. During our testing, we set up one set based on the people working in a department, then broke out subgroups for specific tasks.

A check-out/check-in procedure ensures that only one person can make changes to an object at a time. Though the same object can appear on several people's desktops simultaneously, only one master copy exists. While one person is working on an object others can read it, but they must wait until it is free to make changes. The check-out process could be improved. There's no way to limit how long a file can be checked out.

MOVING YOUR WORK ALONG

Instead of just moving files, a work flow defines and enforces the way the information is routed and handled. The designer of a work flow uses drag-and-drop icons to set up the order in which a series



Office.IQ offers a simple interface for creating compound documents and managing work flow across a workgroup.

of tasks is carried out and to select the basic set of files that are routed from user to user. Then the related objects are automatically routed to all the recipients. They perform their part of the project, add any new documents to the package, and send it on its way. Since the documents are all accessed from the database, users are working with the real files, not copies. We were able to route a complex project to several users with just a few mouse clicks once, we had set up the group. By controlling access levels, we could specify which users could only review objects and which could edit them.

Objects moving in a work flow must travel in the exact order set by the object designer. The program tracks the progression of the object through the system, so its location can be determined at any time. You can also tell just when a work flow reached someone and if they have examined it. You can also route the same object to several people at the same time, but only one of them may actually have a given file in that folder open.

There is a simple way to send an object to someone else on the system. The point-to-point method works like e-mail. Just tell the system what to send and where to send it. The object appears in their mail box. You can add a voice message, or place temporary annotations on image files, and examine .PCX and TIFF files with a built-in viewer. (Office.IQ supports a variety of scanners and CAS-style fax boards. Portfolio says wider support will be included in future releases.)

The software installed easily through the Windows-based setup routine. Pri-

When Color Hits The Road...

"The Northgate Notebook Is An Unbeatable Value!"

—Computer Shopper, March, 1993

There are dozens and dozens of notebook computers on the market today. So when our ZXPortable earned a spot on the cover of the March 1993 issue of Computer Shopper, it was quite an honor, indeed.

In case you missed it, here is an encore performance of the review of our exciting ZXPortable Notebook computer. Take a look...then place your order today. If you aren't completely satisfied with your system, return it within 30 days for a full refund. No questions asked.

Northgate ZXPortable 486SX/25

The ZXPortable 486SX/25, one of two 486-based notebooks in this review,

can be upgraded to a full 486DX CPU. Couple that with its full set of options, the best battery life and relatively low price, and the ZXPortable 486SX/25 stacks up as a value that is hard to beat.

Northgate prices the machine at \$3799, which is quite competitive considering the 486SX CPU powering the unit and everything else that comes standard, including 4MB of RAM, a 120 MB hard disk, a Logitech TrackMan Portable mouse, a fabric carrying case, MS-DOS 5.0, and Windows 3.1.

The ZXPortable uses a Sharp 8.5-inch TFT screen that can display 256 colors at its maximum 640 x 480 resolution. The refresh rate is an acceptable 80ms and the contrast ratio is 60:1. The screen quality is excellent.

The battery life is rated at three hours. While it didn't last that long when running the ZD Labs Battery Rundown test, it did last an average of 2:14:23, the best time among the reviewed notebooks.

No concessions are made to the unit's size or weight in order to boost battery life. The unit measures a trim 2.0 x 11.0 x 8.5-inches and weighs just 6.4 lbs.

The ZXPortable uses a nickel metal hydride battery. The recharge time is a speedy 70 minutes when the notebook computer is off, and 100 minutes when the computer is on. The standard battery-conservation features are available, such as a suspend mode and the ability to cut power to the LCD or hard disk if neither is accessed for a predetermined amount of time.

"The overall value and construction are good, and the battery life is exceptional."

The 86-key keyboard has a solid, responsive touch. It is logically arranged, uses an inverted-T layout for cursor keys and has dedicated PgUp and PgDn keys.

The ZXPortable accepts 16MB of RAM, and the 120MB hard disk is large enough and fast enough (19ms) to handle disk-intensive applications. There is an internal port for a FAX/modem.

A basic docking station (\$599) comes with three ISA slots, two 5.25-inch drive bays, and a 5.25-inch floppy drive. A deluxe docking station (\$999) includes a 14-inch SuperVGA monitor, OmniKey keyboard, and a desktop mouse.

On the service front, Northgate backs the ZXPortable with a one-year parts-and-labor warranty and a 30-day money-back guarantee. Toll-free technical support is available 24 hours a day, 365 days a year.

The ZXPortable is a machine with many strong points and no significant weaknesses. The overall value and construction are good, and the battery life is exceptional. Best of all, all this value is available at a highly competitive price.

Reprinted from Computer Shopper

Want genuine 486DX/25 power?
PC Magazine said... "The Northgate ZXPortable 486DX/25 offered the best bang for the buck!"

March 30, 1993



The optional docking station lets your ZXPortable double as a powerful desktop system.

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Northgate ZXPortable At A Glance

- 486SX/25MHz or 486DX/25MHz processor
- 120MB hard drive (200MB available)
- 4MB RAM (expands to 16MB)
- Active Matrix Color display with 256 simultaneous colors
- 86-key full-travel keyboard
- Nickel metal-hydrate battery for up to 3 hours of power (with power management enabled)
- True 8.5" x 11" size
- Weight: 6.4 lbs.
- MS-DOS 6.0 and Windows™ 3.1
- Logitech™ TrackMan Portable mouse
- Fabric carrying case
- FREE \$395 value PackRat PIM/contact management software

ZXPortable 486SX/25\$3599

ZXPortable 486DX/25\$3799

ZXPortable Monochrome System

ZXPortable 486SX/25\$1899

ZXPortable 486DX/25\$2099

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Docking Station Bundle with 14" SVGA color monitor, OmniKey keyboard, 5.25" floppy drive and desktop mouse.....\$999

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Digital's TeamLinks

A real team player for the VAX office.

by Steven C. M. Chen

Imagine you're in a VAX shop and you need an e-mail/groupware solution: An easy-to-use software package that includes a flexible e-mail system with WAN connectivity capability, cross-platform potential, forms routing and tracking, conferencing, and other goodies. Well, TeamLinks for Windows, Version 1.1, from Digital Equipment Corp., could be just what you're looking for. But solutions don't always come cheap.

A base TeamLinks system for ten users costs \$5,035. This client/server-based application can run on a PC, but it needs a VAX as its server. On the client side, it requires Windows. Additional clients are \$530 each, and other configurations are available.

We looked at a beta version of TeamLinks, Version 1.1—essentially the same as the current shipping version (1.0A), with the addition of TCP/IP support, greater file conversion abilities, and a faster interface. Because it no longer depends on the DECnet protocol, integration to other networking environments is easier. For example, access to a NetWare file server requires only the addition of ODI drivers and a NetWare shell. Recompiled under Microsoft Visual Basic, Version 2.0, TeamLinks 1.1's interface responds much faster than 1.0A's and requires less memory.

THE BIG PICTURE

TeamLinks' shell, or interface, is known as the Information Manager. It serves as the hub for TeamLinks' two main features—e-mail and forms routing.

Sending mail in TeamLinks is as easy as filling out a form. To speed things up, recipient names can be entered by using just the first few characters, dragging them over from the personal address book, or looking up a new name from the directory service.

You can also set up a distribution list for your regularly scheduled mailings. Multiple files can be attached to mail messages. TeamLinks' filing system stores information in folders and file cabinets. File cabinets can reside on a VAX, your hard disk, or other non-VAX servers.

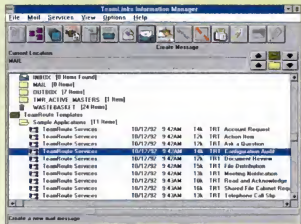
If you want to send mail outside the system, Digital offers optional gateways for PROFS, SNADS, MCI, and MHS.

TeamLinks' mail features are pretty standard fare and include receipt noti-

forms from the sample applications folders. A utility for designing your own routing forms or modifying an existing one is also included. The process is similar to sending an e-mail. In fact, the form is sent as a mail attachment. Each recipient has a predefined role to fulfill, specified by the initiator and designed into the form. Premade forms can contain these predefined roles that you assign to users from an address database. Both initiators and recipients can check the progress of the form by looking at the tracking report.

You can use electronic forms even for sensitive forms that require signature approval. TeamLinks uses passwords as electronic signatures. Comments can be added as well. If you disapprove, you can either let the request continue its route or return it to the sender immediately.

Digital also has an optional BBS-like conference module for TeamLinks. You can read, add to, or reply to a specific topic of discussion with a few simple mouse clicks.



Routing is easy with TeamLinks for Windows; just pick one of the predefined forms to help start the task.

cations, important-message flags, and reply requests. There are, however, one or two nice extras, such as the inclusion of expiration dates for messages or replies.

CREATE A TRAIL

Have you ever wasted valuable time tracking a routed memo or listening to excuses from the people who "never received it"? That will be a thing of past with TeamLinks. The forms-routing feature, TeamRoute, tracks the movement of files and messages along a predetermined list of recipients and checks the status of any approvals requested.

You start a routing process by selecting 1 of the 11 predefined routing

LAUNCH AND RUN

Currently, only WordPerfect for Windows, Version 5.2, has built-in hooks to TeamLinks. But eventually, other Windows-based applications, such as Ami Pro, Lotus 1-2-3, Microsoft Excel, Version 4.0, and Microsoft Word for Windows, will also be able to launch e-mail directly and have direct access to TeamLinks filing cabinets and support its long filenames and folders. These links will be either bundled with the applications or available separately. Other products, such as Network Scheduler 3 for DOS and Windows, from PowerCore, will have a special version that

works with TeamLinks.

Installing the TeamLinks client on a PC is no harder than installing any other Windows application. But if you're setting up TCP/IP for the first time, there are other issues. Each PC must have a unique Internet address—a consideration you'll need to deal with ahead of time. Server installation can be involved, especially if you need to set up everybody's mail address. You will have to enter them one at a time and TeamLinks doesn't offer much help.

For the VAX-less office, TeamLinks may seem like an attractive solution if you can justify the high start-up cost. But don't forget the time it will take to get

*TeamLinks' mail features
are pretty standard fare.
There are, however,
one or two nice extras,
such as the inclusion of
expiration dates for
messages or replies.*

the support staff up and running. You may want to wait until TeamLinks migrates to another platform, such as Microsoft Windows NT, before considering it. □

► FACT FILE

TeamLinks, Version 1.1

Digital Equipment Corp., 146 Main St., Maynard, MA 01754; 800-344-4825, 508-493-5111; fax, 508-493-8780.

List price: For sites with existing VAX servers, \$530 per node. Additional server software may be required. For setup (including MicroVAX 3100 with complete client and server software and license for ten users), \$36,956. Additional configurations available.

Requires: Server: VAX. Workstation: Microsoft Windows 3.x, DEC Pathworks or TCP/IP package.

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many files and the database must reside on a server running NetWare, Version 3.11, but you have the option of placing copies of the program file on each node to reduce network overhead. The initial setup automatically creates a list of potential users from the NetWare 3.11 Bindery. Everyone with a network account is given a Root-Level folder.

OFFICE SETUP

It was simple to configure the program as desired, but the organization of the dialog boxes took a bit of getting used to. System administration is simple enough and should not take much time. Figuring out how to access advanced features was slow. The Getting Started Guide lacked adequate illustrations, and the Administrator's Guide and User's Guides were task-oriented in a way that we found somewhat confusing.

Office.IQ offers the right mix of features for basic document management in a group setting, but it still lacks advanced enforcement and full-text search options needed by many organizations. Nevertheless, its combination of desktop and work-flow metaphors is well integrated and provides a good framework for collaborative computing.

Futurus Corp.

Futurus Team DOS/Windows Combo

BY RON ANDERSON

Futurus Team DOS/Windows Combo, from Futurus Corp., is a capable and



expensive package that covers the bases of workgroup communications, with some bonuses thrown in. At \$649 for the five-user version, Futurus Team provides DOS and Windows clients with LAN-based e-mail, group scheduling, phone messaging, real-time conferencing ("chatting"), a group contact database, note and card files, and some useful DOS utilities. Of these many goodies,

► FACT FILE

Futurus Team DOS/Windows Combo

Futurus Corp., 211 Perimeter Center Pkwy., #910, Atlanta, GA 30346; 800-327-8296, 404-392-7979; fax, 404-392-9313

List price: For 1 user, \$149; for 5 users, \$649; for 25 users, \$2,495; for 100 users, \$4,995.

Requires: Server: No RAM, 3MB hard disk space. DOS workstation: 640K RAM, VGA video (for fax viewing), DOS 3.1 or later. Windows workstation: 2MB RAM (4MB recommended). Chat module requires a NetBIOS or Novell IPX-based network.

In short: Futurus Team DOS/Windows Combo offers e-mail, scheduling, phone messaging, chatting, and group-based note and card files for both DOS and Windows clients. Though automatic work flow is missing, the performance and features are good for this relatively inexpensive product.

ON READER SERVICE CARD

three—wide area messaging, real-time chatting, and scheduling—cross the mystical border into the land called groupware. Futurus Team makes no provision for automating work flow, however, so if you're looking for this feature, you'll need to look elsewhere.

FAMILIAR FACES

In a direct comparison, the DOS client comes out looking stronger than the Windows client, primarily a result of its superior overall integration. While it presents a unified menu structure for accessing Futurus Team's various modules, each Windows module is implemented as a separate program. Your screen becomes very crowded once two or three of these modules are opened simultaneously on the Windows desktop.

The e-mail module is robust. Mail messages, file attachments, and faxes can be sent to local or remote users and groups. Remote LAN users are accessible via optional gateways, including Futurus TEAM WAN, which provides real-time connections across separate Novell LANs (\$695). For cross-platform e-mail exchange, there's Futurus Team MCI Mail Gateway (\$995 for unlimited users) and Futurus Team MHS Gateway (\$995 for unlimited users).

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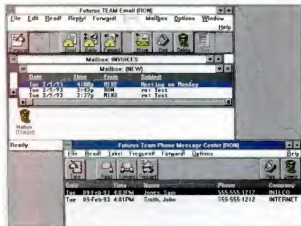
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Unlike BeyondMail's integrated forms approach, Futurus Team's phone message module is separate from the e-mail module. Phone message forms, similar to the ubiquitous paper forms found in most offices, are quick and easy to complete. A nice feature here is the system-wide frequent-caller database. You can easily add a caller to the database, and Futurus Team's phone message module performs automatic look-ups as you type the caller's name. Phone numbers and company information are filled in automatically when a match is found.

MEETING CITY

The scheduling module provides individual and group scheduling and a to-do list. When you schedule an event for a group, Futurus Team's scheduling module searches across your selected users' and



Futurus Team's Windows interface works neatly with its DOS companion, but the Windows desktop can get crowded.

resources' schedules for common blocks of free time. The scheduling module also provides a graphical display of participants' schedules to help you fine-tune your meeting time. Remote MHS users cannot be scheduled in this manner because their schedules are not available to the local network. Those connected via TEAM WAN, however, can be included.

Notification of upcoming group meetings is provided to local users automatically through e-mail. You can keep track of each participant's RSVP status through a graphical display.

Futurus Team's conferencing function enables five people at a time to converse over the network via their keyboards. Users on separate networks connected together with Futurus Team's proprietary

WAN can participate in cross-network conferences. This provides at least a shadow of the functionality provided by heavyweight conferencing products such as Ventana Corp.'s GroupSystems 5.

The DOS and Windows clients share the same data files on the server, so switching between them during the day presents no problems. The Windows client does require you to load Futurus Team's DOS TSR program before you start Windows. The DOS TSR memory overhead of 6K to 12K is acceptable for DOS users, but Windows users are unnecessarily inconvenienced by this requirement.

SETTING UP

Futurus Team's installation routine is smooth and well thought out. It automatically creates the necessary directories and copies files to the appropriate places. If you install Futurus Team on a NetWare network, users and groups can be added automatically from the NetWare Bindery. Otherwise, adding users, groups, and resources is a manual process in the DOS-only administration module. If Futurus Team detects that your network is using Novell's Message Handling System (MHS), it offers you the choice of using the system for Futurus Team's mail delivery system. Futurus Team routes mail on its own if MHS

isn't available.

As with all networked messaging products, administrative burdens increase as connections to external gateways proliferate. The administration tools included with Futurus Team are limited but suitable for the small LANs and workgroups for which this product is most appropriate. Futurus Team should not require a large part of any administrator's time and effort.

Futurus Team simplifies and enhances many day-to-day group-oriented communications tasks at a reasonable cost. Sending memos and phone messages, managing personal schedules and to-do lists, and scheduling and confirming group meetings are all areas of your daily work that could benefit from its use. □



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Average Seek Time	16 msec
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Non-Operating Shock	150 G's
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CIRCLE 195 ON READER SERVICE CARD

Copying the Volume Label

Handy DOS Help

BY NEIL J. RUBENKING

COPYING THE VOLUME LABEL—REVISITED

The batch program VCOPY.BAT that was published in the August 1992 User-to-User column is, unfortunately, incorrect. If the source floppy disk has the volume label "A B C D E F", which is exactly 11 characters long (six letters plus five spaces), the batch file would copy only the substring "A B C D E" to the destination floppy disk. The program fails in this case since F becomes the tenth batch file parameter, which is not accessed by the program.

To correct the problem, you need to use the DOS SHIFT command in the batch file in order to access the tenth parameter. Moreover, the original program is very inflexible since the source and destination drives cannot be specified at run-

time. Finally, it's always a good idea to use the /V (verify) switch when copying files to a floppy disk.

Figure 1 shows VCOPY2.BAT, a new version of the program that takes care of all of these problems, including allowing users to copy from a source drive %1 to a destination drive %2 (VCOPY2 B: A:, for example).

Note that if the source floppy disk is not labeled and the destination floppy disk is labeled, the destination disk will retain its label. This shouldn't cause any problems.

*Victor G. Alter
Buffalo, New York*

► **PC MAGAZINE:** I may be able to leap tall DOS commands with a single keystroke,

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but sometimes I just can't count! Quite a few readers wrote to point out that the original VCOPY.BAT could handle labels containing four spaces, not five. A simple call to the SHIFT command brings the tenth parameter within reach, allowing VCOPY2.BAT to copy a volume label with the maximum possible number of spaces.

I added a few lines to VCOPY2.BAT to validate the two new command line parameters, allowing only drives A: and B:. If your system has more than two floppy disk drives, simply add their letter designations, both upper and lowercase, to the two FOR loops near the beginning of the batch file.

Note, too, that VCOPY2.BAT still can't correctly copy labels that contain a series of spaces. Any number of adjacent spaces in the original label will be reduced to a single space on the copy. For example, letting the underscore represent a space, the label FOO____BAR would become FOO_BAR.

The corrected version of the batch program—VCOPY2.BAT—is available for downloading from the Utilities/Tips Forum on PC MagNet.

VCOPY2.BAT

Complete Listing

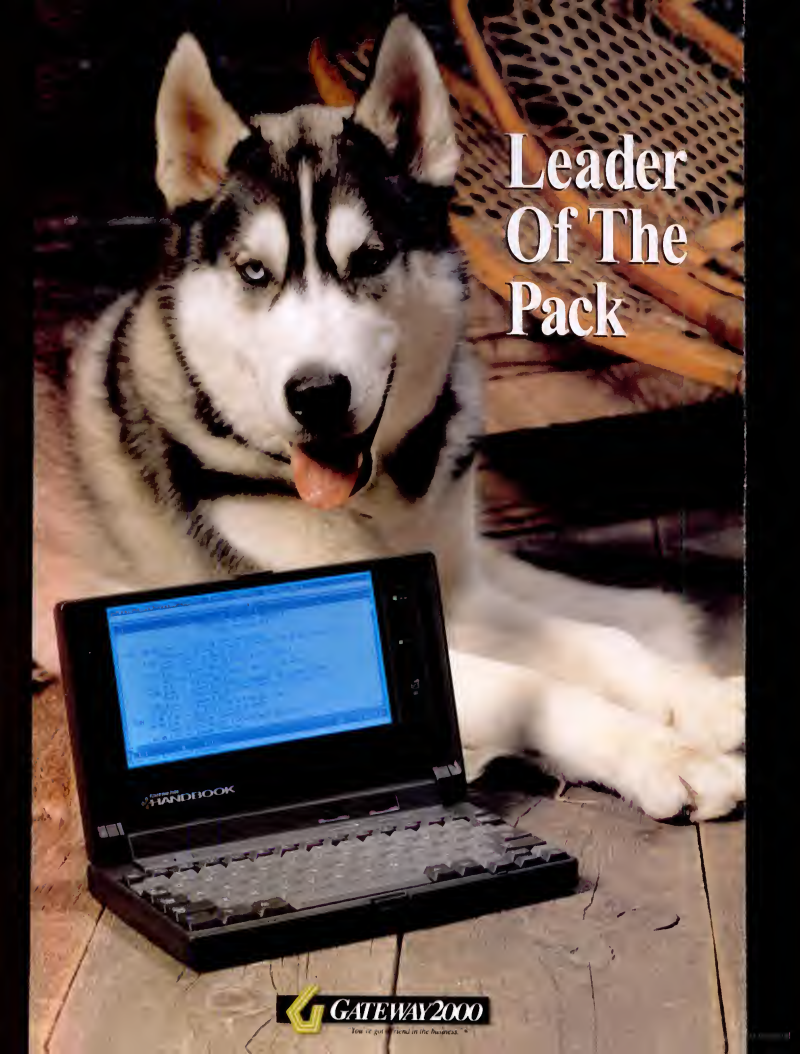
```
@ECHO OFF
::Purpose: Copy all files and the volume label from drive %1 to drive %2
FOR %v IN (a: A: b: B:) DO IF '%1'=='%v' GOTO Ok1
GOTO Syntax
:Ok1
FOR %v IN (a: A: b: B:) DO IF '%2'=='%v' GOTO Ok2
GOTO Syntax
:Ok2
XCOPY %1\ %2\ /s /e /v
ECHO @echo off> volume.bat
ECHO if '%4'=='has' goto end> volume.bat
ECHO shift>> volume.bat
ECHO label: %2%4 %5 %6 %7 %8 %9>> volume.bat
ECHO <end>> volume.bat
VOL %1
VOL %1|FIND "drive"> VCOPY_GO.BAT
CALL VCOPY_GO
VOL %2
DEL VOLUME.BAT
DEL VCOPY_GO.BAT
GOTO End
:Syntax
ECHO SYNTAX: VCOPY2 d1: d2:
ECHO where d1 and d2 are floppy drive letters
:End
```



Figure 1: This corrected version of VCOPY.BAT copies one floppy disk to a possibly different-size floppy disk, label and all.

HANDY DOS HELP

I wrote a little batch program, named HELPRINT.BAT, that lets you easily create a personal DOS command refer-

A husky dog with black and white fur is lying on a wooden deck. Its tongue is hanging out, and it is looking directly at the camera. In front of the dog is a small, black, clamshell-style laptop. The laptop screen is open and displays a blue screen with some text. The laptop has "GATEWAY 2000" and "HANDBOOK" printed on the bezel below the screen. The background is a wooden deck with a woven wicker chair visible behind the dog.

Leader Of The Pack



*Frank Teasley,
1991 winner of the
Iditarod's
Humanitarian
Award for the best
cared-for team, used
his Gateway 2000
HandBook
throughout the race
to keep records on
his dogs and race
progress.*



*Regularly priced at
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is now only \$995.
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Go The Distance!

Frank said the HandBook's exclusive auto-resume feature was a big plus, too. Being able to open the HandBook and start working exactly where he left off made it effortless to use.

Although the dogs slept an average of 12 hours a day during the race, Frank was lucky to sleep 45 minutes daily. He was busy making straw beds, putting ointment on the dogs' feet, replacing their polar fleece booties, preparing their food, repairing harnesses and repacking while the dogs rested. "Sleep deprivation can be hazardous to a musher's ability to focus on details. The HandBook kept me on top of my schedule so I could concentrate on the dogs and they could concentrate on what they love best: the race."

Frank concluded, "There's not another computer small enough or powerful enough to come through for us the way the HandBook did."

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2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



GbsSlipSheet-001

Inverted Foldout slip-sheet

Folded edge of the page

1. Open the foldout page

2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



Gbr51p8ack-0018

Back

1. Follow Instructions on the other side



Gateway's HandBook Is The First Portable To C

On March 6, 1993, 68 men and women, 1,253 dogs and one portable computer left the starting line in the 21st running of the Iditarod dogsled marathon. Not all of the men, women and dogs made it through nearly 1,100 miles of blinding snow, howling wind, mountainous terrain and sub-zero temperatures – but the PC did!

It was the first time anyone ever took a portable all the way from Anchorage to Nome on a dogsled. Appropriately, the first portable PC to go the distance was the first product in an entirely new category of portables; the unique and innovative product that defined new standards for portable PCs: the HandBook, pioneered by Gateway 2000. At just 2.75 pounds, measuring

only 6 x 10 inches yet including a 40MB hard drive, a backlit, use-it-anywhere screen and comfortable keyboard, the HandBook was the only choice for Iditarod musher Frank Teasley.

"I've always wanted a way to carry my racing strategy with me and to record my progress during the race," said Frank. "But I can't afford any extra weight on the dogsled, and you don't find many electrical outlets on the trail. The HandBook easily fit in the dogsled, and I used it at checkpoints to review details of the trail ahead, information on my competition, and notes on my dogs." Because he couldn't recharge batteries on the trail, Frank ran his HandBook on AA batteries kept warm in his parka.

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26 PEOPLE 6 PLATFORMS 1 SIMPLE SOLUTION



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Deleting and Undeleting Files From Your Disk

BY JEFF PROSISE

Have you ever stopped and wondered how it is that DOS can undelete an erased file? Peter Norton discovered the secret years ago and parlayed his knowledge into a fortune with The Norton Utilities' famous UnErase program. UnErase was the first of its kind, and it spawned many imitators. Fortunately, you don't have to buy a third-party undelete utility if you use DOS 5.0 or 6.0, because both have an UNDELETE command built in.

The art of undeleting files may seem like magic to the uninitiated, but it's actually quite simple when you understand how DOS stores files on-disk and what it does when it deletes them. Here, then, is a behind-the-scenes description of how files are deleted and how they can be undeleted. After reading this, you should have a better understanding of the finer points of DOS file management.

DISK STORAGE BASICS If you're unfamiliar with the concept of the file allocation table (FAT) and the way DOS stores files on a disk, it may be helpful to review last issue's Tutor column. Recall that sectors in the data area of a disk—the part of the disk that DOS uses for file storage—are grouped together into units called *allocation units*, or *clusters*. Depending on the size of the disk, a cluster is typically 1, 2, 4, or 8 sectors in length. Logical volumes greater than 256MB use even larger cluster sizes. A 2GB logical volume uses 64 sectors per cluster, resulting in a 32K cluster size.

The FAT, which contains one 12- or 16-bit entry for each cluster on the disk, keeps a record of which clusters are used and which ones are free. A FAT entry of 0 means the corresponding cluster is free. A nonzero value means it contains

file data. If the entry falls within the range (F)FF0h to (F)FF7h (the digits in parentheses apply to 16-bit FATs only), then one or more of the sectors in the cluster is defective and the cluster should not be used for storage. Clusters (and FAT entries) are numbered sequentially, beginning with the number 2. The number of the final cluster is equal to the total number of clusters on the disk, plus 1.

When DOS creates a new file, it starts by creating a 32-byte directory entry that contains information about the file, such as its name, length, and the time and date it was created. The directory entry also includes a record of the file's *starting cluster*—the number of the first cluster used to store the file's information. Next,

*If you understand
how DOS stores and
deletes files on disks,
you'll realize that
undeleting files isn't
pure magic after all.*

beginning with the FAT entry whose number is the same as that of the starting cluster, DOS fills in entries in the FAT in order to create a record of where the file is stored.

An example will help you picture this in your mind. Suppose that a file requires four clusters of storage space, and that clusters 10, 11, 12, and 13 are the first four available. DOS copies the file data to clusters 10 through 13 and then sets the starting cluster field in the file's directory entry to 10. Then it writes an 11 to FAT entry number 10, a 12 to FAT entry num-

ber 11, and either FFFFh (16-bit FATs) or FFFh (12-bit FATs) to FAT entry number 13. FFFFh and FFFh are special FAT entries that signify the end of a chain. When it is asked to read this file, DOS obtains the starting cluster number from the file's directory and then follows the linked list of allocation entries through the FAT until it reaches the end-of-chain marker. The chain of allocation entries for this file is illustrated schematically in Figure 1.

DELETING AND UNDELETING THE FILE

Now suppose you ask DOS to delete the file. It's reasonable to guess that DOS might erase the file's directory entry and all the information pertaining to the file in the FAT. It could even erase the clusters where the file itself is stored.

In fact, DOS does little of the above. To erase a file, DOS first goes to the file's directory entry and overwrites the first character in the filename with the value E5h. Then it writes zeros to the file's FAT entries, erasing the record of where the file was stored. Significantly, all the characters in the filename except the first are left intact. The remainder of the directory entry is left intact, too, including the file's size and starting cluster number. More importantly, the file itself is still intact in the data area of the disk. Have you ever noticed that it doesn't take DOS any longer to delete a very large file than it does to delete a very small one? That's because the information contained in the file is not erased. There's really no need to erase it, because now that the clusters are marked free, they will be filled with new data when a new file is created or an existing file is lengthened. Figure 2 shows what the FAT looks like after the file is deleted.

The classic method for undeleting a file involves scanning a disk's directory entries for a filename whose first charac-

How DOS Stores a File

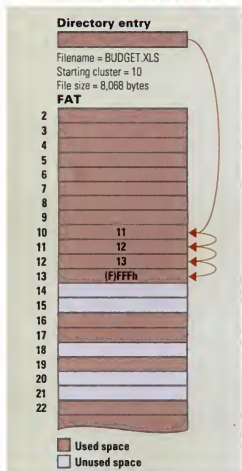


Figure 2: To record a file's location on-disk, DOS places the starting cluster number in the file's directory entry, and then creates a linked list of allocation entries in the FAT. The final cluster in the chain is marked with the value FFFFh in 16-bit FATs, FFFFh in 32-bit FATs.

ter is E5h and whose remaining characters match the ones that are specified by the user. For example, in order to locate the directory entry for an erased file whose name is BUDGET.XLS, search for the characters <E5h>UDGET.XLS. Once the directory entry is located, the file's starting cluster number can be obtained from the directory entry. In addition, the number of clusters that the file consumed can be computed by dividing the file size (in bytes) by the number of bytes per cluster.

We now have in hand the key pieces of information needed to undelete the file: the directory entry, the starting cluster number, and a cluster count. We can undelete the file by replacing the first character in the filename (undelete programs typically ask the user to supply the

missing character) and then restoring the file's FAT entries, beginning with the starting cluster number obtained from the directory entry. When this has been done, the file will once again look just like it did in Figure 1.

Obviously, this can't work if another file has claimed the clusters that were occupied by the deleted file. That's why it's important to undelete a file as soon as possible after deleting it. The longer you wait, the greater the chance that DOS will have reused the space occupied by the deleted file, and the less likely you'll be able to recover it.

Even if the space occupied by the deleted file is still free, this method of undeleting is not 100 percent effective. Its greatest weakness is that it assumes that the deleted file was stored in contiguous, sequentially numbered clusters. In our example, the starting cluster number (which was determined from the directory entry) was 10, and the number of clusters that the file occupied (determined by dividing the file size obtained from the directory entry by the length of one cluster) was 4. Since clusters 10, 11, 12, and 13 were all free, it was reasonable to guess that all four clusters once belonged to the deleted file. But what if the file had been fragmented? What if it had been stored in, say, clusters 10, 11, 156, and 157? Had this been the case, undeleting might have been impossible because there's no reliable way the undelete program can pick out clusters 156 and 157 from the hundreds—perhaps thousands—of other free clusters on the disk. This is one more good reason to defragment the files on your hard disk on a regular basis. Defragmented files occupy sequential clusters and are therefore more easily undeleted!

DELETE TRACKING To make up for this weakness in the "classic" form of undeleting, DOS 5.0 and 6.0 offer an additional form of delete protection called *delete tracking*. Delete tracking is activated with the MIRROR command in DOS 5.0 (for example, MIRROR /TC activates delete tracking for drive C:) and with the UNDELETE command in DOS 6.0 (for example, UNDELETE /TC). When delete tracking is active, DOS pauses whenever a file is deleted and copies information about the file—including

a list of the clusters it occupies—to a hidden file called a *delete-tracking file*. If you later decide to undelete the file, DOS uses information in the delete-tracking file to determine which clusters the file occupied. This takes the guesswork out of restoring the record of the file in the FAT. It even lets DOS restore the first character in the filename without prompting you for it, because the original filename is stored in the delete-tracking file along with the information about the file's location.

Even delete tracking isn't perfect, however. It works fine as long as the space occupied by an erased file is still unused, but it's powerless to help if another file has come along and claimed that space for itself. Therefore it's still im-

When a File Is Deleted

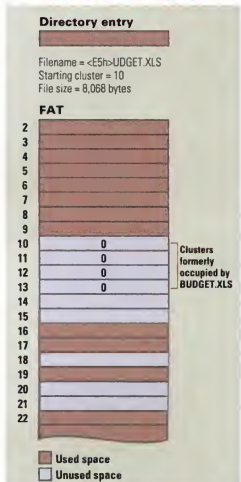


Figure 2: To delete a file, DOS overwrites the first character in the filename with the value E5h and zeros out the FAT entries that correspond to the file. Much of the information needed to undelete the file—the starting cluster number, the record of the file's size, and the contents of the clusters in which the file is stored—remains intact.

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portant to undelete a file as soon as possible after deleting it.

When you undelete a file with DOS 5.0's UNDELETE command, DOS first attempts to restore the file, using delete tracking. If there is no delete-tracking file, or if there one is but it contains no record of the deleted file (to keep the delete-tracking file from growing so large that it monopolizes disk space, DOS limits its size and purges records of old files to make room for new ones), DOS resorts to the classic method of undeleting. Your DOS manual calls this a *DOS undelete*. DOS 6.0 behaves the same way, but before it tries either method of undeleting, it checks to see if you activated a third and more effective form of delete protection, called *sentry undelete*.

SENTRY UNDELETE Sentry undelete is the most effective of the three forms of delete protection. In DOS 6.0, the command UNDELETE /SC activates sentry protection for the C: drive; parameters governing sentry delete's operation (such as whether it will protect files whose archive bits are set) are stored in the text

file UNDELETE.INI, stored in the DOS directory of your hard disk. When you choose sentry undelete, DOS 6.0 creates a hidden subdirectory on your hard disk, named SENTRY. When you attempt to delete a file, DOS moves the file to the SENTRY directory, where it can easily be recovered by moving it back to the original directory. Since the record of the file is never removed from the FAT, you don't have to worry about other files reclaiming the space used by the "deleted" file. To keep the SENTRY directory from growing uncontrollably, DOS occasionally purges it—throws out old files—to make room for more files. The only time sentry undelete will fail you, then, is when the file you want to restore has been purged. (Note: Sentry undelete will also fail if the directory the file was stored in no longer exists.) As usual, the sooner you attempt to undelete a file after deleting it, the better.

Now that you understand how undeleting works, you can see that it isn't so magical after all. It's surprising that DOS wasn't endowed with its own undelete

utility until Version 5.0, because the DEL command was designed from day one to enable deleted files to be undeleted. It's even more surprising that Microsoft didn't write the UNDELETE command itself, but instead licensed it from Central Point Software.

You can also see why merely deleting a file does not ensure that the information in it can't be recovered. That's why some government installations require that employees use Norton's WipeFile or a similar utility to dispose of files containing sensitive data. WipeFile erases all traces of a file. It even destroys the contents of the clusters where the file was stored, optionally overwriting their contents several times with alternating bit patterns to ensure that the data can't be recovered with sophisticated electronic equipment that is sensitive to very low voltage fluctuations.

DOS doesn't provide an equivalent to WipeFile, but if you're a programmer armed with the knowledge of how DOS stores files on disks, it's not difficult to create one. □

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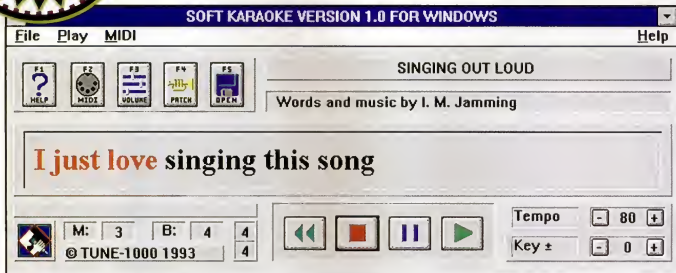
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Creating Hidden Credit Screens In Windows Programs

BY DANNY THORPE

Why do professional applications sometimes contain elaborate, hidden windows with silly animations and self-congratulatory messages? And if they're there, why are such credits so very hard to find? These questions have recently stirred quite a debate in various computer publications. "Imagine how much disk space this nonsense takes up!" protest the letters to the editor. "The time spent to write this fluff could have been better used to code new features or fix bugs!" scold the editorials.

As a Windows programmer, I was originally rather surprised by the outcry and have since been a little amused by the media frenzy. Granted, some of the credit screens—bitmapped photos of the whole development team, for example—do seem a bit too self-indulgent and costly. But the vast majority of such hidden screens requires neither a lot of code nor a lot of time to write. When properly done, an interesting—even entertaining—credit screen will have negligible impact on the size of the program in which it's embedded.

To prove the above claim, this article will show you how to write your own hidden credit screens in Windows programs using a flexible and reusable object. The sample programs in this article—one each in Borland Pascal 7.0 and Borland C++ 3.1—will demonstrate that such fluff can be trivial in terms of .EXE size. And frankly, it's just the sort of lighthearted weekend project with which to cap off an all-too-serious 18-month development cycle.

A CREDIT SCREEN BACKGROUNDER The credit screen is the place in an application where the program's copyright notices

and acknowledgements are presented. In Windowspeak, such screens are called "About Boxes." In DOS command line utilities the credits are usually simple: a single line of text, such as "Copyright 1988 by Danny Thorpe," is displayed when the program runs. On the other hand, flashy graphical applications simply beg for something more attuned to their graphical environment—a nice bit-map, at the least.

Early Windows programs were generally plain and simple, as were their credit screens. Microsoft's application design guidelines—*The Windows Interface: An*

for registering shareware, and other essential information.

Particularly business-card-like is the belief that the About Box should (or can) make a quick, memorable impression, usually through colorful graphic images and distinctive text fonts. The About Box statement is one of the few devices in your product package that can provide users with a lasting mental image or impression of you and your company. From a marketing perspective, or as a way to generate product name recognition, the About Box statement ranks in importance with the artwork on the covers of your documentation and retail boxes. The retail box cover may entice the user to purchase the product, but the box is thrown away almost immediately. Documentation sits on the shelf, falls apart, or just gets lost. Only the About Box, which is built in to the program, will last as long as the program and accompany it wherever it goes.

The About Box, with rather simple text and perhaps a few adornments, is still the norm among smaller development teams and independent programmers. However, a simple dialog box doesn't work very well for large development teams: It's a little difficult to plunk 30 names into any dialog and make it attractive. The solution that comes to mind immediately is to scroll a list of credits in a smaller dialog box.

Why are the more interesting credit screens often hidden? Nothing requires that credits be concealed from the public, but I suspect corporate policy often plays a role. Policymakers like to insist that it's unprofessional to list names of real people alongside the company logo; a corporate image should transcend individual personalities. Also, many companies would rather not publish the names of their key developers in a legitimate effort

*If properly written, these
controversial screens
don't adversely affect
code size or speed, and
can be just the right
finishing touch.*

Application Design Guide, Chapter 8, Section 8.6—called for an About Box dialog that was accessible from the Help menu and that displayed the name of the program, a version number, copyright notices, and required licensing acknowledgements. Followed to the letter, these early guidelines made for bare minimum credit screens.

Since those days, however, the *raison d'être* for the About Box has expanded so that it has become something of a billboard mini-advertisement for the program and its author or authoring company. Like a business card, today's About Box often displays the author's name, how to contact the author for support or

ABOUT.RC

Complete Listing

```
DLGABOUT DIALOG 36, 16, 96, 113
STYLE DS_MODALFRAME | WS_POPUP | WS_CAPTION | WS_SYSMENU
CLASS "bordlg"
CAPTION "About"
BEGIN
    CONTROL "", 100, "BorShade", 32769 | WS_CHILD | WS_VISIBLE, 8, 6, 88, 78
    CONTROL "OK", 1, "BorBtn", 1 | WS_CHILD | WS_VISIBLE | WS_TABSTOP, 31, 88, 34, 18
    CONTROL "", 101, "BorShade", 2 | WS_CHILD | WS_VISIBLE, -2, 88, 100, 2
    CONTROL "&I", 103, "BorBtn", 0 | WS_CHILD | WS_VISIBLE, -56, -58, 4, 6
END
```

Figure 1: ABOUT.RC, the resource template for the About Box dialog.

to protect their valuable workforce from predatory recruiters.

Be that as it may, everyone enjoys acknowledgement of a job well done. We all want to have a place to point to and say "That's me! I did that, there's the proof." So when policy pushes the credits out, the mischievous imps at the core of all great software invariably find other avenues of expression—credit screens that are hidden, and sometimes very hard to find. The rest of this article is directed to the mischievous imp in you.

REQUIREMENTS FOR OUR ABOUT BOX The About Box that we will create here contains a hidden credit screen. The small amount of code that is required to display a traditional About Box is usually isolated from the rest of a program's code, so inserting a few customizations there won't affect the rest of the program. The About Box will normally display a bitmap containing the required copyright and version information. When the user presses a secret hotkey, however, the Box will display its hidden credits by scrolling text and/or a list of names up through the bitmap area. As the end of the list scrolls away, the normal bitmap will scroll back into place.

To keep things simple, we'll use a single hotkey to activate the hidden credits. Implementing a system to handle elaborate Control-Alt-keystroke sequences to activate the hidden credits is not an easy task in an isolated Windows dialog.

In terms of code, we want a self-sufficient, reusable ObjectWindows object that will take care of the details. Ideally, all that the main program should have to provide to the About Box is the data unique to each application: the bitmap to be displayed in the About Box and the text of the credit list. It goes without say-

ing that the code should be as small as possible, to minimize the cost of including this indulgence in the program.

Let's start by looking at the dialog resource template (ABOUT.RC) for our About Box as shown in Figure 1. This dialog uses the Borland Windows Custom Control library (BWCC.DLL). The dialog class BorDlg gives us a chiseled-steel dialog background. A BorShade control, the BWCC gray group box, covers a large portion of the dialog and will frame our About Box bitmap. The BorShade with ID 101 is a horizontal speed-bump custom control, which displays a raised line dividing the bitmap display area from the OK button.

According to the resource script, this dialog contains two BWCC bitmapped buttons (BorButton), but when you look at the dialog box itself, shown in Figure 2, you will see only one OK button. Where and what is that &I button?

That's the first trick. The &I button has been placed at negative coordinates, which means that it will never be visible in the About Box dialog. It won't be immediately visible in a visual resource editor such as Resource Workshop, either, should someone open up your finished .EXE file to look at your resources. The hidden button could be located by other means, but most people won't go to those lengths and will pass right over the odd button in this dialog template.

Even though the &I button isn't visible, its shortcut key (I) remains active. Instead of having our application dabble in keystroke handling to activate the hidden credit list, we can

simply slip a button into the dialog and listen for a click message from the button. This provides a very simple, yet discreet, activation system. When the user presses the I key while the About Box is displayed, the hidden credit list is set in motion. The activation mechanism is completely local to the About Box and doesn't require any assistance from the main program, which is another bonus.

Notice that the About Box resource script doesn't contain a bitmap and that the OK button isn't quite centered in the dialog. The About Box object (described next) will accept a bitmap resource name from the main program when the object is initialized. The dialog object will resize and center itself and its controls to suit the dimensions of the provided bitmap. This makes the About Box almost totally self-sufficient, requiring zero maintenance in future applications that use it—a double bonus!

ABOUT.PAS The complete source code for the ABOUT.PAS unit is listed in Figure 3. The TAboutBox object runs the About Box dialog itself. The TCreditWindow object will be created on the fly by the TAboutBox.Init constructor, and it will be responsible for the actual display of the bitmap and the scrolling credit text.

The two data fields of the TAboutBox object are a title string pointer and the CreditWindow instance pointer. The Init constructor receives pointers to its parent window (usually the application's main window); a title string; a bitmap resource name or identifier; and an array of strings that is passed as a constant open array



Figure 2: The About Box's normal appearance, with a bitmap supplied by the client application. Note that the About Box will resize itself to fit around the supplied bitmap.

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CIRCLE 081 ON READER SERVICE CARD

ABOUT.PAS

1 of 2

```

(*****)
( About box unit )
( Copyright (c) 1993 by Danny Thorpe )
( )
( for Borland Pascal 7.0 )
(*****)

unit About;

interface

uses Winprocs, Wintypes, Objects, OWindows, ODialogs;

($R About.res)

const
  IdShade = 100;
  IdBump = 101;
  IdHotKey = 103;

type
  PCharArray = ^TCharArray;
  TCharArray = array [0..65520 div sizeof(PChar)] of PChar;

  PCreditWindow = ^TCreditWindow;
  TCreditWindow = object(TWindow)
    Bitmap: HBitmap;
    BitSize: TBitMap;
    ScrollUnit: Integer;
    ScrollRate: Integer;
    ScrollPos: Integer;
    FontHeight: Integer;
    StringList: PCharArray;
    StringCount: Word;
    constructor Init(AParent: PWindowsObject;
      ABitmapName: PChar;
      const AStringList: Array of PChar);
    destructor Done; virtual;
    function GetClassName: PChar; virtual;
    procedure GetWindowClass(var WC: TWndClass); virtual;
    procedure SetupWindow; virtual; { First place HWindow is valid }
    procedure WMDestroy(var Msg: TMessage); { Last place HWindow is valid }
    virtual wm_First + wm_Destroy;
    procedure Paint(DC: HDC; var PS: TPointStruct); virtual;
    procedure ShowCredits; virtual;
    procedure WMTimer (var Msg: TMessage);
    virtual wm_First + wm_Timer;
  end;

  PAboutBox = ^TAboutBox;
  TAboutBox = object(TDialog)
    Title: PChar;
    CreditWindow: PCreditWindow;
    constructor Init(AParent: PWindowsObject;
      ATitle, ABitmapName: PChar;
      const AStringList: Array of PChar);
    destructor Done; virtual;
    procedure SetupWindow; virtual;
    function GetResName: PChar; virtual;
    procedure InitCreditWindow(ABitmapName: PChar;
      const AStringList: array of PChar); virtual;
    procedure ShowCredits(var Msg: TMessage);
    virtual Id_First + IdHotKey;
  end;

implementation

uses Strings;

constructor TCreditWindow.Init(AParent: PWindowsObject;
  ABitmapName: PChar;
  const AStringList: Array of PChar);
var
  DC: HDC;
  OldFont: HFont;
  TM: TTextMetric;
begin
  inherited Init(AParent, nil);
  Attr.Style := wa_Child or wa_Visible;
  Bitmap := LoadBitmap(HInstance, ABitmapName);
  if Bitmap = 0 then
    begin
      Status := ew_InvalidWindow;
      Exit;
    end;
  GetObject(Bitmap, sizeof(BitSize), @BitSize);
  ScrollPos := 0;
  DC := GetDC(0);
  ScrollUnit := 2;
  ScrollRate := 00;
  OldFont := SelectObject(DC, GetStockObject(ANSI_VAR_FONT));
  GetTextMetrics(DC, TM);
  FontHeight := TM.tmHeight + TM.tmExternalLeading + 5;
  SelectObject(DC, OldFont);
  ReleaseDC(0, DC);
  StringList := @AStringList;
  StringCount := High(AStringList)+1;
end;

destructor TCreditWindow.Done;
begin
  inherited Done;
  DeleteObject(Bitmap);
end;

function TCreditWindow.GetClassName: PChar;
begin
  GetClassName := 'OWLAboutBitmap';
end;

procedure TCreditWindow.GetWindowClass(var WC: TWndClass);
begin
  inherited GetWindowClass(WC);
  WC.Style := ws_ByteAlignWindow; { for BitBlt speed }
  WC.hbrBackground := GetStockObject(Black_Brush);
end;

procedure TCreditWindow.SetupWindow;
begin
  inherited SetupWindow;
  SetWindowPos(HWindow, 0, 0, 0, BitSize.bmWidth, BitSize.bmHeight,
    swp_NoMove or swp_NoZOrder or swp_NoActivate or swp_NoRedraw);
end;

procedure TCreditWindow.WMDestroy(var Msg: TMessage);
begin
  if ScrollPos <> 0 then { We're scrolling and need to kill the timer }
    begin
      KillTimer(HWindow, 1);
      ScrollPos := 0;
    end;
  inherited WMDestroy(Msg);
end;

procedure TCreditWindow.Paint(DC: HDC; var PS: TPointStruct);
var
  R: TRect;
  FirstLine, LastLine, Y: Integer;
begin
  procedure DrawBitmap(Y: Integer);
  var
    MemDC: HDC;
    OldBits: HBitmap;
  begin
    MemDC := CreateCompatibleDC(DC);
    OldBits := SelectObject(MemDC, Bitmap);
    BitBlt(DC, 0, Y, Attr.W, Attr.H, MemDC, 0, 0, srccopy);
    SelectObject(MemDC, OldBits);
    DeleteDC(MemDC);
  end;

  begin
    SaveDC(DC);
    SetViewportOrg(DC, 0, -ScrollPos);
    OffsetRect(PS.rcPaint, 0, ScrollPos);
    with R do
      begin
        Left := 0;
        Top := 0;
        Right := Attr.W;
        Bottom := Attr.H;
      end;
    if Bool(IntersectRect(R, PS.rcPaint, R)) then
      begin
        DrawBitmap(0);
        with PS.rcPaint do
          begin
            if (R.Top < Top) and (R.Bottom > Top) then R.Bottom := R.Bottom;
            if (R.Top < Bottom) and (R.Bottom > Bottom) then Bottom := R.Top;
            if Top > Bottom then Top := Bottom;
          end;
        end;
        if ScrollPos > 0 then { we're scrolling }
          begin
            FirstLine := (PS.rcPaint.Top - Attr.H) div FontHeight;
            if FirstLine < 0 then FirstLine := 0;
            if FirstLine < StringCount then
              begin
                { we have text to draw }
                SetTextAlign(DC, TA_Center);
                SetBkColor(DC, 0);
                SetTextColor(DC, RGB($ff,$ff,$ff));
                LastLine := (PS.rcPaint.Bottom - Attr.H) div FontHeight;
                for Y := FirstLine to LastLine do

```

Figure 3: ABOUT.PAS, the Pascal OWL source code for an About Box and hidden credits window.

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ABOUT.PAS

2 of 2

```

if Y < StringCount then
  TextOut(DC, Attr.M div 2, Y*FontHeight + Attr.H,
    StringList[Y], StrLen(StringList[Y]));
end;
{ Paint second image of bitmap at bottom }
if PS.rcPaint.Bottom > (Attr.H*FontHeight*StringCount) then
  DrawBitmap(Attr.H + FontHeight * StringCount);
end;
RestoreDC(DC, -1);
end;

procedure TCreditWindow.ShowCredits;
begin
  SetTimer(HWND, 1, ScrollRate, nil);
end;

procedure TCreditWindow.WMTimer(var Msg: TMessage);
begin
  Inc(ScrollPos, ScrollUnit);
  { Check to see if it's time to stop scrolling }
  if ScrollPos > Attr.H + FontHeight * StringCount then
  begin
    ScrollPos := 0;
    KillTimer(HWND, 1);
    InvalidateRect(HWND, nil, False);
  end
  else
    ScrollWindow(HWND, 0, -ScrollUnit, nil, nil);
  UpdateWindow(HWND);
end;

{*****}

constructor TAboutBox.Init(AParent: PWindowsObject;
  ATitle, ABitmapName: PChar;
  const AStringList: array of PChar);
begin
  inherited Init(AParent, GetResName);
  Title := StrNew(ATitle);
  InitCreditWindow(ABitmapName, AStringList);
end;

destructor TAboutBox.Done;
begin
  inherited Done;
  if Title <> nil then
    StrDispose(Title);
end;

procedure TAboutBox.SetupWindow;
var
  RDialog, R, RBitWnd, RShade, RButton, ROK: TRect;
  X8, Y8: Integer;
  DC: HDC;
begin
  inherited SetupWindow;
  SetWindowText(HWND, Title);
  DC := GetDC(HWND);
  X8 := GetDeviceCaps(DC, LogPixelsX) div 8; { 1/8 inch }
  Y8 := GetDeviceCaps(DC, LogPixelsY) div 8;
  ReleaseDC(HWND, DC);
  GetClientRect(GetDlgItem(HWND, idShade), RShade);
  GetClientRect(GetDlgItem(HWND, idButton), RButton);
  GetClientRect(GetDlgItem(HWND, idOK), ROK);
  GetClientRect(CreditWindow*HWND, RBitWnd);
  RShade.Top := Y8;
  RShade.Left := X8;
  if RShade.Right < RBitWnd.Right + 2*X8 then
    RShade.Right := RBitWnd.Right + 2*X8;
  if RShade.Bottom < RBitWnd.Bottom + 2*Y8 then
    RShade.Bottom := RBitWnd.Bottom + 2*Y8;

  with RDialog do
  begin
    GetWindowRect(HWND, RDialog);
    GetClientRect(HWND, R);
    Right := Right - Left - R.Right;
    Bottom := Bottom - Top - R.Bottom;
    Right := Right + X8 + RShade.Right + X8; { 1/8 inch margins }
    Bottom := Bottom + Y8 + RShade.Bottom
      + Y8 + RButton.Bottom
      + Y8 + ROK.Bottom + Y8;

    if Parent <> nil then
    begin
      GetWindowRect(Parent*HWND, R);
      { Center dialog in parent's window }
      Left := R.Left + (R.Right - R.Left) div 2 - Right div 2;
      Top := R.Top + (R.Bottom - R.Top) div 2 - Bottom div 2;
    end;
    SetWindowPos(HWND, 8, Left, Top, Right, Bottom,
      swp_NoActivate or swp_NoZOrder);

  end;
  with RShade do
  begin
    SetWindowPos(GetDlgItem(HWND, idShade), 8, Left, Top,
      Right, Bottom, swp_NoActivate or swp_NoZOrder);
    SetWindowPos(GetDlgItem*HWND, 8, Left + X8, Top + Y8, 0, 0,
      swp_NoActivate or swp_NoSize or swp_NoZOrder);

  end;
  with RButton do
  begin
    Left := -1;
    Right := RDialog.Right + 2;
    Top := RShade.Top + RShade.Bottom + Y8;
    SetWindowPos(GetDlgItem(HWND, idButton), 8, Left, Top, Right, Bottom,
      swp_NoActivate or swp_NoZOrder);

  end;
  GetClientRect(HWND, R);
  with ROK do
  begin
    SetWindowPos(GetDlgItem(HWND, idOK), 8,
      R.Right div 2 - Right div 2,
      RButton.Top + RButton.Bottom + Y8, 0, 0,
      swp_NoActivate or swp_NoZOrder or swp_NoSize);

  end;
end;

function TAboutBox.GetResName: PChar;
begin
  GetResName := 'dialbox';
end;

procedure TAboutBox.InitCreditWindow(ABitmapName: PChar;
  const AStringList: array of PChar);
begin
  CreditWindow := New(PCreditWindow, Init(8Self, ABitmapName, AStringList));
end;

procedure TAboutBox.ShowCredits(var Msg: TMessage);
begin
  CreditWindow*.ShowCredits;
end;

end.

```

parameter. Constant parameters and open array parameters are new language features of BP7; for conversion to earlier Pascals, see the notes at the end of the article.

The title string is a constructor parameter that allows the application to provide the dialog with a customized title (for example, "About Borland Pascal"), instead of having to use whatever title is in the About Box's own dialog template. Remember, we want to reuse this About Box in many applications, so any application-specific information should be given

to us by the application.

TAboutBox.Init passes the bitmap resource name and string list array in a call to InitCreditWindow, which is a virtual method of TAboutBox. InitCreditWindow initializes CreditWindow as an instance of the TCreditWindow type, passing its parameters on to TCreditWindow.Init. Putting this type-specific initialization in a virtual method allows future descendants of TAboutBox to override this method and use a different kind of TCreditWindow—presumably a descendant of TCreditWindow. No other

changes to the TAboutBox descendant will be necessary to install a different kind of CreditWindow. I think of this as *nondeterministic component initialization*, since the type of the component objects used by the main object is not entirely fixed or predetermined and so can be overridden in descendants. (This point is further discussed in the sidebar, "Creating Reusable Code.")

Figure 4 is the C++ version of this OWL object, which implements the same About Box behavior as our Pascal example. Because C++ has an aversion to vir-

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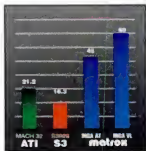
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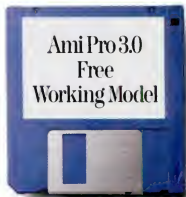
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CIRCLE 143 ON READER SERVICE CARD

■ Creating Reusable Code

by Danny Thorpe

Component type-determinism is an important issue that you must consider when you're designing a set of reusable objects. Reusable, inheritable objects don't just happen; they must be *designed* to be good ancestors, so to speak. Among other things, beyond imposing a general-purpose base component type, good ancestors avoid forcing type specifics on their descendants. You can set up mechanisms to defer type-specific decisions (such as creating component instances) so as to provide the descendants with the greatest range of flexibility.

At some point in the hierarchy, of course, the type decisions must be made. The objects could be called terminal nodes of the object inheritance tree, since they do not work well as ancestors and rarely have descendants. You might also call these terminal nodes mules, for they usually do a lot of work and tend to be sterile. All OOP applications contain mule objects that perform specific tasks or operations, together with fertile, inheritable objects that handle general tasks and provide overall structure, code reuse, and modularity.

Calling a virtual method to perform type-specific work is one kind of type deferment mechanism. The base object can provide a useful default and still leave descendants an easy way to change that default in order to meet their specific needs. In the present program, without providing some kind of way for descendants to specify their own component types, we would be faced with either locking the TAboutBox object into using only a TCreditWindow instance, or with requiring the caller to provide a CreditWindow instance as a parameter to the Init constructor. The latter is very undesirable, as it opens up the internal details of the About Box to the client app and places greater requirements upon it. The name of the game in object-oriented programming is reducing components'

exposure of internal details to one another, and reducing the requirements on the client.

C++ doesn't like the idea of calling a virtual method within a constructor. When you call a virtual method you're potentially calling down into a descendant's code. Technically, if you're calling the virtual method from within an ancestor's constructor, the descendant has not yet been completely initialized. Thus you run the risk that the descendant's virtual method may use a data field of the object that hasn't been initialized. You run the same risk of this error in Pascal, but there are some additional pitfalls in C++'s automatic constructors that make the danger in C++ more real than that in Pascal. For this and other reasons, C++ compilers usually convert virtual method calls made in constructors into static calls. A static call from an ancestor's constructor will only call the ancestor's version of a method after the ancestor's data is initialized, as opposed to making a virtual call down into the descendants' versions of a method before the descendants' data is initialized. This makes the call safe; however, it completely defeats the purpose of the virtual method!

Another possible deferment mechanism for both C++ and Pascal is to avoid construction of the ClientWindow instance in the TAboutBox constructor at all. You can simply leave it nil until some later stage of the object's execution, a stage at which it is safe to call a virtual method. Such an opportunity is available in OWL. An OWL object's construction is split into two parts: things that happen before the Windows window handle has been created (the Init constructor) and things that happen after (the SetupWindow method). InitCreditWindow could thus be called from TAboutBox.SetupWindow, and this is in fact the solution that the C++ version of TAboutBox uses. The problem with this approach is that the object could

be successfully initialized by its constructor but later fail during construction of one of its components. The object, in other words, would temporarily exist in a partially complete state, and this situation is an open invitation for bugs.

In either solution, some part of the object's code is executed while the object is in a partially constructed state. Responsible coding by the author of the original object will minimize descendants' exposure to the partially constructed state. No less important is that documentation of what is and is not allowed during the incomplete phase will let the programmers of descendants of the object know what they can and should do.

The payoff is flexibility and reuse of the original object as well as portions of its original components in other areas of the same program, or in new projects down the line. In the excitement of a successful OOP project, you often hear of an object's being used in "a new context unforeseen by the original author." *Unforeseen* isn't quite accurate. The original author may not have envisioned your *particular* extensions while writing the object, but had that author not given some thought to how the object might need to be altered or enhanced, and spent the time driving out unnecessary assumptions and building in override opportunities, you wouldn't be able to apply your extensions in the first place.

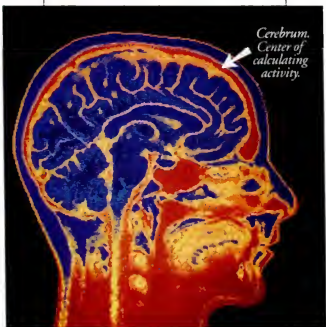
Writing reusable code doesn't mean you have to identify all future uses and extensions of the code. You need only identify the replaceable parts of the existing design and take moderate steps to ensure your base code doesn't contain assumptions that would prevent or block such modifications. Identify enhancement opportunities rather than specific enhancements themselves. Component type-deferment is one technique for providing override opportunities and making an object more reusable. □

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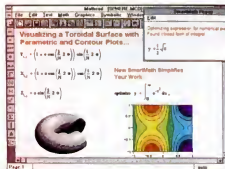
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CIRCLE 154 ON READER SERVICE CARD

ABOUT.CPP and ABOUT.H

1 of 2

A

```

//
// About box object for C++ OWL
//
// Copyright 1993 by Danny Thorpe
//

#include "about.h"

TCreditWindow::TCreditWindow(PtWindowObject AParent,
                             LPCSTR ABitmapName, LPSTR AStringList[])
    : TWindow(AParent, NULL)
{
    HDC DC;
    HFONT OldFont;
    TEXTMETRIC TM;
    LPSTR P;

    Attr.Style = WS_CHILD | WS_VISIBLE;
    Bitmap = LoadBitmap(GetApplication()->hInstance, ABitmapName);
    if (!Bitmap)
    {
        Status = EM_INVALIDWINDOW;
        return;
    }
    GetObject(Bitmap, sizeof(Bitmap), &Bitmap);
    ScrollPos = 0;
    DC = GetDC(0);
    ScrollUnit = 2;
    ScrollRate = 88;
    OldFont = SelectObject(DC, GetStockObject(ANSI_VAR_FONT));
    GetTextMetrics(DC, &TM);
    FontHeight = TM.tmHeight + TM.tmExternalLeading + 5;
    SelectObject(DC, OldFont);
    ReleaseDC(DC, DC);
    StringList = AStringList;

    // Count strings in stringlist.
    for (StringCount = 0; StringList[StringCount]; StringCount++);

TCreditWindow::~TCreditWindow()
{
    DeleteObject(Bitmap);
}

void TCreditWindow::GetWindowClass(WNDCLASS& WC)
{
    TWindow::GetWindowClass(WC);
    WC.style = CS_BYTEALIGNWINDOW; // for BitBlt speed
    WC.hbrBackground = GetStockObject(BLACK_BRUSH);
}

void TCreditWindow::SetupWindow()
{
    TWindow::SetupWindow();
    SetWindowPos(HWNDtop, 0, 0, BitSize.bmWidth, BitSize.bmHeight,
                SWP_NOMOVE | SWP_NORESTORE | SWP_NOACTIVATE | SWP_NOREDRAW);
}

void TCreditWindow::WMDestroy(RTMessage Msg)
{
    if (ScrollPos) // We're scrolling and need to kill the timer
    {
        KillTimer(HWNDtop, 1);
        ScrollPos = 0;
    }
    TWindow::WMDestroy(Msg);
}

void DrawBitmap(HDC DC, int X, int Y, int W, int H, HBITMAP Bitmap)
{
    HDC MemDC = CreateCompatibleDC(DC);
    HBITMAP OldBite = SelectObject(MemDC, Bitmap);
    BitBlt(DC, X, Y, W, H, MemDC, 0, 0, SRCCOPY);
    SelectObject(MemDC, OldBite);
    DeleteDC(MemDC);
}

void TCreditWindow::Paint(HDC DC, PAINTSTRUCT& PS)
{
    RECT R;
    int FirstLine, LastLine, Y;

    SaveDC(DC);
    SetViewPortOrg(DC, 0, -ScrollPos);
    OffsetRect(&PS.rcPaint, 0, ScrollPos);
    R.left = 0;
    R.top = 0;
    R.right = Attr.W;
    R.bottom = Attr.H;

    if (IntersectRect(&R, &PS.rcPaint, &R))
    {
        DrawBitmap(DC, 0, 0, Attr.W, Attr.H, Bitmap);
        if ((R.top > PS.rcPaint.top) && (R.bottom > PS.rcPaint.top))
            PS.rcPaint.top = R.bottom;
        if ((R.top < PS.rcPaint.bottom) && (R.bottom > PS.rcPaint.bottom))
            PS.rcPaint.bottom = R.top;
        if (PS.rcPaint.top > PS.rcPaint.bottom)
            PS.rcPaint.top = PS.rcPaint.bottom;
    }
    if (ScrollPos > 0) // we're scrolling
    {
        FirstLine = (PS.rcPaint.top - Attr.H) / FontHeight;
        if (FirstLine < 0)
            FirstLine = 0;
        if (FirstLine < StringCount)
        {
            // we have text to draw
            SetTextAlign(DC, TA_CENTER);
            SetBkColor(DC, 0);
            SetTextColor(DC, RGB(0xff, 0xff, 0xff));
            LastLine = (PS.rcPaint.bottom - Attr.H) / FontHeight;
            for (Y = FirstLine; Y <= LastLine; Y++)
            {
                if (Y < StringCount)
                    TextOut(DC, Attr.W / 2, Y * FontHeight + Attr.H,
                           StringList[Y], _fstrlen(StringList[Y]));
            }
            // Paint second image of bitmap at bottom
            if (PS.rcPaint.bottom > (Attr.H + FontHeight * StringCount))
                DrawBitmap(DC, 0, Attr.H + FontHeight * StringCount,
                           Attr.W, Attr.H, Bitmap);
        }
        RestoreDC(DC, -1);
    }
}

void TCreditWindow::ShowCredits()
{
    SetTimer(HWNDtop, 1, ScrollRate, NULL);
}

void TCreditWindow::WMTimer(RTMessage)
{
    ScrollPos += ScrollUnit;
    // Check to see if it's time to stop scrolling
    if (ScrollPos > Attr.H + FontHeight * StringCount)
    {
        ScrollPos = 0;
        KillTimer(HWNDtop, 1);
        InvalidateRect(HWNDtop, NULL, FALSE);
    }
    else
        ScrollWindow(HWNDtop, 0, -ScrollUnit, NULL, NULL);
    UpdateWindow(HWNDtop);
}

//.....
AboutBox::AboutBox(PtWindowObject AParent,
                   LPCSTR ATitle,
                   LPCSTR ABitmapName,
                   LPSTR AStringList,
                   LPSTR AResName)
    : TDialog(AParent, AResName)
{
    Title = _fstrdup(ATitle ? ATitle : "");
    BitmapName = ABitmapName;
    StringList = AStringList;
}

AboutBox::~AboutBox()
{
    if (!HINSTANCE(Title))
        free((void*)Title);
}

void AboutBox::SetupWindow()
{
    RECT RDialog, RBitWnd, RShade, RThumb, ROK;
    int XB, YB;
    HDC DC;

    InitCredWindow(BitmapName, StringList);
    TDialog::SetupWindow();
    SetWindowText(HWNDtop, Title);
    DC = GetDC(HWNDtop);
    XB = GetDeviceCaps(DC, LOGPIXELSX) / 8; // 1/8 inch
    YB = GetDeviceCaps(DC, LOGPIXELSY) / 8;
    ReleaseDC(HWNDtop, DC);
    GetClientRect(GetDlgItem(HWNDtop, IDSHADE), &RShade);
    GetClientRect(GetDlgItem(HWNDtop, IDBUMP), &RBump);
    GetClientRect(GetDlgItem(HWNDtop, IDOK), &ROK);
}

```

Figure 4: ABOUT.CPP (A) and ABOUT.H (B), the Borland C++ OWL source code for an About Box.



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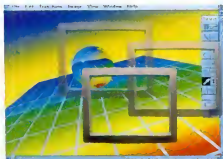
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CIRCLE 228 ON READER SERVICE CARD

ABOUT.CPP and ABOUT.H

2 of 2

```

GetClientRect(CreditWindow->HWindow, &RBitWnd);
RShade.top = Y8;
RShade.left = X8;
if (RShade.right < RBitWnd.right + 2*X8)
    RShade.right = RBitWnd.right + 2*X8;
if (RShade.bottom < RBitWnd.bottom + 2*Y8)
    RShade.bottom = RBitWnd.bottom + 2*Y8;

GetWindowRect(HWindow, &RDialog);
GetClientRect(HWindow, &R);
RDialog.right = RDialog.right - RDialog.left - R.right;
RDialog.bottom = RDialog.bottom - RDialog.top - R.bottom;
RDialog.left += X8 + RShade.right + X8; // 1/8 inch margins
RDialog.bottom += Y8 + RShade.bottom
            + Y8 + ROK.bottom + Y8;

if (Parent)
{
    GetWindowRect(Parent->HWindow, &R);
    // Center dialog in parent's window
    RDialog.left = R.left + (R.right - R.left) / 2
        - RDialog.right / 2;
    RDialog.top = R.top + (R.bottom - R.top) / 2
        - RDialog.bottom / 2;
}
SetWindowPos(HWindow, 0, RDialog.left, RDialog.top,
    RDialog.right, RDialog.bottom,
    SWP_NOACTIVATE | SWP_NOZORDER);

SetWindowPos(GetDlgItem(HWindow, IDSHEAD), 0, RShade.left,
    RShade.top, RShade.right, RShade.bottom,
    SWP_NOACTIVATE | SWP_NOZORDER);
SetWindowPos(CreditWindow->HWindow, 0, RShade.left + X8,
    RShade.top + Y8, 0, 0,
    SWP_NOACTIVATE | SWP_NOZORDER);

Rbump.left = -1;
Rbump.right = RDialog.right + 2;
Rbump.top = RShade.top - RShade.bottom + Y8;
Rbump.bottom = GetDlgItem(HWindow, IDBUMP), 0, Rbump.left,
    Rbump.top, Rbump.right, Rbump.bottom,
    SWP_NOACTIVATE | SWP_NOZORDER);

GetClientRect(HWindow, &R);
SetWindowPos(GetDlgItem(HWindow, IDOK), 0,
    R.right / 2 - ROK.right / 2,
    Rbump.top + Rbump.bottom + Y8, 0, 0,
    SWP_NOACTIVATE | SWP_NOZORDER);
}

void TabAboutBox::InitCreditWindow(LPCSTR AbitmapName, LPSTR AStringList)
{
    CreditWindow = new TCreditWindow(this, AbitmapName, AStringList);
}

void TabAboutBox::ShowCredits(RTMessaga)
{
    CreditWindow->ShowCredits();
}

```

```

#include <owl.h>
#include <owldefs.h>
#include <ctrl.h>
#include <alloc.h>

#define IDSHEAD 100
#define IDBUMP 101
#define IDOKKEY 103

class TCreditWindow : public TWindow {
public:
    BITMAP Bitmap;
    BITMAP BitSize;
    int ScrollUnit;
    int ScrollRate;
    int ScrollPos;
    int FontHeight;
    LPSTR* StringList;
    int StringCount;

    TCreditWindow(PWindowObject AParent,
        LPCSTR AbitmapName,
        LPSTR AStringList[])
    {
        virtual ~TCreditWindow();
        virtual LPSTR GetClassName() {return "OWLAboutBitmap*";}
        virtual void GetWindowClass(WNDCLASS& WC);
        virtual void SetupWindow(); //
        // First place HWindow is valid
        virtual void WMDestroy(RTMessaga Msg) //Last place HWindow is valid
        {
            = [WM_FIRST + WM_DESTROY];
            virtual void Paint(HDC DC, PAINTSTRUCT& PS);
            virtual void ShowCredits();
            virtual void WMTimer(RTMessaga Msg)
            {
                = [WM_FIRST + WM_TIMER];
            }
        }
};

_CLASSDEF(TAboutBox) // this is potentially exportable

class TAboutBox : public TDialog {
public:
    LPCSTR Title, BitmapName;
    LPSTR* StringList;
    TCreditWindow* CreditWindow;
    TAboutBox(PWindowObject AParent,
        LPCSTR ATitle,
        LPCSTR AbitmapName,
        LPSTR AStringList[],
        LPSTR AResName = "dlgAbout");
    virtual ~TAboutBox();
    virtual void SetupWindow();
    virtual void InitCreditWindow(LPCSTR AbitmapName, LPSTR AStringList);
    virtual void ShowCredits(RTMessaga Msg) = (ID_FIRST + IDOKKEY);
};

```

tual method calls from within constructors, nondeterministic component initialization is achieved in this case through a virtual method call from the SetupWindow method, after the constructor has initialized the object.

The Pascal TAboutBox also has a GetResName function, which returns the string name of the dialog template from which TAboutBox creates itself. This, too, is a virtual function that is called from the Init constructor. TAboutBox descendants can override the GetResName virtual function to force TAboutBox to use a different resource template. The resource template name must be de-

termined when the object is constructed—it cannot wait until later in the object's execution lifetime, for instance at the point at which SetupWindow is called. In the C++ TAboutBox, the resource name is provided as an optional parameter to the constructor with a default value. Descendants or clients can therefore pass in different resource names if they so choose.

TAboutBox.SetupWindow does all the resizing of the dialog and controls so that they suit the size of the ClientWindow's bitmap. By the time execution returns from the call to the inherited SetupWindow, the ClientWindow has been

created, has loaded the specified bitmap, and has sized itself to fit the bitmap's dimensions. TAboutBox.SetupWindow then undertakes some tedious calculations so that the gray group box will frame the ClientWindow, the dialog will frame the group box, and everything will be centered horizontally in the dialog.

The last notable method built into TAboutBox is the ShowCredits method. This method will be called when the About Box dialog receives a button-click notification from the hidden &I button in the dialog template. As you can see in Figure 3, ShowCredits simply notifies the CreditWindow that it's *show time!*

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TCREDITWINDOW **TCreditWindow** actually does all the work of scrolling the credit text and painting an innocuous bitmap facade. Most of the time it just sits there, innocently displaying the bitmap. When the user activates the credit list (via the hidden button's hotkey), the **CreditWindow** starts a timer message to itself and begins scrolling the bitmap up out of view and printing the credit text strings, centered, on the window. With each timer message received, the bitmap is rolled up a little further and more text is displayed. When all the text has scrolled by, the bitmap is gracefully scrolled back into view from the bottom, as though the whole contraption were on a continuous loop of paper running through a player piano.

The **Init** constructor loads the bitmap into memory using the provided resource name. Note that **Windows** lets you identify a resource by a string *or* by an integer ID. When writing code that handles resource names, therefore, you must not forget that the string pointer you're given might not be a pointer at all, but instead might be an integer resource identifier. If the pointer is an integer identifier, the

selector (high word) will be zero. Dereferencing a pointer with a zero selector will cause a General Protection Fault and crash your program! Thus you must remember not to treat this resource name as a string pointer unless you check that the pointer's selector (high word) is non-zero.

The bitmap's dimensions are retrieved by calling **GetObject**. The **CreditWindow** will resize itself to these bitmap dimensions in its **SetupWindow** method. Finally, the constructor makes note of the height of the system variable-pitch font—the font that will be used to display the credit text. The constructor also keeps a pointer to the constant array of strings and notes the size of the array.

The **GetClassName** and **GetWindowClass** methods work as a pair. **GetWindowClass** changes some of the default window class attributes for the **CreditWindow**. It requests the **cs_ByteAlign** window class style in order to make the **CreditWindow**'s in-memory screen image start on an even byte boundary. **BitBlt** operations are a bit faster on byte-aligned windows than on nonaligned windows, and the **CreditWindow** will be

doing lots of **BitBlt**ing during its text-scrolling operation. The performance difference is noticeable on slower video cards running in 16-color mode (4 bits per pixel). **GetWindowClass** also sets the class background brush to a black brush. This black background won't be visible while the bitmap is displayed, since the window is the same size as the bitmap, but it will form the background for the scrolling credit text.

In order to register and use this altered window class with **Windows**, you must make **GetClassName** return a new, unique window class name. Whenever you alter the window class record, you must provide a new class name. You should be careful when thinking up new window class names, too: Initially, I had **GetClassName** return **OWLABOUTCREDITS**. The name is fine, but bear in mind that window class names are easy for others to find and browse using such **Windows** debugging tools as **WinSight**. If you're trying to conceal some detail of your program's implementation—such as the very existence of hidden credits—it's not too bright to announce it by the window class name. It's better to use the

DEMPROG.PAS and DEMOPROG.RC

Complete Listing

```

A
*****
( About box demo program )
( Copyright (c) 1993 by Danny Thorpe )
( for Borland Pascal 7.0 )
*****

program Demo;
uses Winprocs, Wintypes, OWindows, SHCC, About;

{$R demo.res}

const
  cmAbout = 101;
  idBitmap = 200;

CreditText: array[1..7] of PChar = (
  '',
  'This is where you would',
  'put your own list of',
  'names or secret message',
  'to reward the users who',
  'discover this.',
  '' );

type
  TDemoMainWindow = ^TDemoMainWindow;
  TDemoMainWindow = object (TMainWindow)
    procedure cmAbout (var Msg: TMessage); virtual;
  end;

  TDemoApp = object (TApplication)
    procedure InitMainWindow; virtual;
  end;

procedure TDemoApp.InitMainWindow (var Msg: TMessage);
begin

```

```

Application^.BoxedDialog (New (PAboutBox,
  Init) (Self, 'Demo About Box', PChar (idBitmap), CreditText));
end;

procedure TDemoApp.InitMainWindow;
begin
  MainWindow := New (TDemoMainWindow, Init ('Demo App',
    LoadMenu (HInstance, 'Main Menu')));
end;

var App: TDemoApp;
begin
  App.Init ('Demo');
  App.Run;
  App.Done;
end.

B
#include "lp7\units\owindows.inc"

MAINMENU MENU
BEGIN
  POPUP "File"
  BEGIN
    MENUITEM "Exit \Alt-X", CM_EXIT
  END

  POPUP "Help"
  BEGIN
    MENUITEM "About...", 101
  END
END

200 BITMAP "chess.bmp"

```

Figure 5: A minimal demo program (A) and resource script (B) that display an About Box.

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less revealing class name OWLAboutBitmap instead.

TCreditWindow.SetupWindow resizes the window to fit the bitmap dimensions. Note that this method gets called before TAboutBox.SetupWindow really starts its work. TAboutBox.SetupWindow calls inherited SetupWindow, which in an ancestor's method calls the SetupWindow methods of all the child windows (that is, CreditWindow) before returning to TAboutBox.SetupWindow. This is worth noting because TAboutBox.SetupWindow's layout code assumes the CreditWindow is in final form, matching the bitmap dimensions. The assumption is fine, but it may not be obvious that TCreditWindow.SetupWindow is called immediately prior to the execution of TAboutBox's layout code.

The Paint method displays the bitmap when the CreditWindow is in nonscrolling mode and displays the scrolling bitmap and text when in scrolling mode. This method is all nuts-and-bolts output code, so it should require no further comment.

ShowCredits starts the scrolling action by initializing a timer message for the CreditWindow. Those timer messages get routed to the WMTimer method. For each timer message received, WMTimer increments the scroll offset counter and sends a new paint message by calling ScrollWindow. If the scroll offset counter indicates that the scroll has come full circle, WMTimer kills the timer message and the CreditWindow grows quiet once again.

As a last item of note, TCreditWindow has a WMDestroy method that re-

sponds to wm_Destroy window messages. As the Done destructor is to the Init constructor, WMDestroy is to SetupWindow: WMDestroy is the last point of execution in an OWL object at which the object's HWindow handle is valid. SetupWindow is the first place the HWindow is valid.

What would happen if the user clicked on the OK button in the AboutBox dialog while the credit list was scrolling? Or closed the dialog using the system menu? TAboutBox would shut itself down, dispose of its child window objects, and then dispose of itself. If the CreditWindow were still scrolling, however, its timer message would still be "live" and should be killed as part of a clean shutdown of the window. TCreditWindow.Done would be called as the last part of the shutdown, but note that by that point HWindow is no longer a valid handle. The Windows window is already gone, and to kill the timer message you need that window handle. The last opportunity to use HWindow is in the WMDestroy message handler, and that's where TCreditWindow kills any active timer.

So much for the About Box and its special components. Now let's see what it looks like and how it works. Figure 5A is the source listing for a minimal test program; and Figure 5B is that test program's resource script, consisting of a menu and a bitmap. When you compile this program, run it, and pull down the Help: About menu, you'll get the About Box shown back in Figure 2. Hitting the I key starts the credit text scrolling, a snapshot of which can be seen in Figure 6. Mission accomplished!

The Borland Pascal compiler compiles this About Box unit down to about 2,300 bytes of code. That's how much larger your finished application will be for including this About Box with its hidden credit window. Not only is 2K small in itself, but it's also virtually unnoticeable at a time when most commercial Windows programs have .EXE files that are well over 100 or 200K. And once you have established a sound base of code such as this basic About Box, you can em-

bellish and add new behaviors without adding much more machine code.

The strings of credit text that are given to the About Box will take up space in the program's code or data segments. As an alternative, you could put the string list out in the program's resource file—after all, a string table is a Windows resource. The reason that this alternative is undesirable is that resources are very easy to view and edit these days, so it's not a good idea to put somewhat sensitive information (like names) in an easily viewable string table. You certainly wouldn't want someone to slip his own name or text into your string table! Further, plain strings are easy to spot in the .EXE file if you use a binary file editor. To keep prying eyes out of your sensitive program data, you would need to employ some sort of encryption system, but that is beyond the scope of this article.

The files that accompany this article can be downloaded from the Programming Forum on PC MagNet, archived as ABOUT.ZIP. (See the "Downloading Utilities" sidebar in this issue's Utilities column for instructions.) The Pascal source is written for Borland Pascal 7.0 and uses many of Version 7.0's new language enhancements. A separate version of the Pascal source code is also provided for TPW 1.0 and TPW 1.5 owners. The C++ source is written for BC++ OWL Version 3.1.

Credit screens are as much a part of the software culture as huge linebackers mouthing "Hi Mom!" to a roving television camera are a part of football culture. Creative animated credit screens often evoke the same reactions as a football player spiking the ball in the end zone and briefly strutting around the field: Many fans find it entertaining, some folk consider it unprofessional, and some players go a bit overboard. If you've finally reached the stage of putting the last flourishes on a new software product, take the time to unwind every now and then; learn to laugh at yourself. Spike the ball, do a little dance, strut a few steps. You've earned it. □

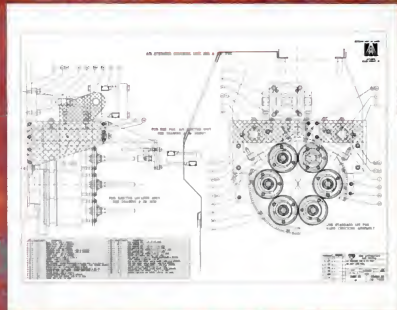
DANNY THORPE IS A SENIOR QUALITY ASSURANCE ENGINEER IN THE PASCAL COMPILER GROUP AT BORLAND INTERNATIONAL.



Figure 6: A snapshot of the About Box dialog while the credit text is scrolling by.

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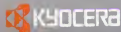


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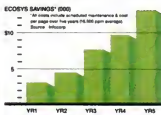
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Bring Your Desktop to Life with ICON ANIMATOR

BY PHILIP B. ESKELIN, JR.

Not only do icons add fun to your Windows environment, they also make minimized programs easier to recognize. With programs like IconDraw, Borland's Resource Workshop, Norton's icon editor, or with our own IKE utility (*PC Magazine*, March 26, 1991), you can customize your icons, but we decided to go a step further. Until now, icons have remained static and inert. Wouldn't it be nice to see the pencil scribble back and forth when you minimize NOTEPAD?

ICON ANIMATOR is a Windows 3.1 utility that gives you the ability to bring an icon to life when you minimize a running application, by displaying a timed sequence of icon frames in place of the usual static icon. Up to 16 animation sequences can be used at once, each associated with a different application. The frame rate (the amount of time between frames) for each sequence is user-selectable, and different animated icons can run at different speeds.

The easiest way to get a copy of ANIMATOR is to download the archive ANIMAT.ZIP from the Utilities/Tips Forum on PC MagNet, as explained in the sidebar, "Utilities by Modem." ANIMAT.ZIP contains the executable program and the complete C-language source code, including resource files, header files, and icon files. (You can also download just the ANIMAT.EXE executable file itself.) To recompile the program after making changes of your own, you'll need either the Borland C++ 3.1 compiler or the Microsoft C 6.0 compiler and the Windows SDK.

As an alternative to downloading, you can get a copy of the executable and its source files on-disk, without charge. Simply send a postcard or a fax request speci-

fying the program name and desired disk format, together with your name and address, to: Katherine West, Utilities, *PC Magazine*, One Park Ave., New York, NY 10016-5802. The fax request number is 212-503-5799; no phone calls, please.

Before you can put ICON ANIMATOR to work, of course, you must create the individual images (the frames) that will comprise the animation sequence. For this you'll need a separate icon edi-

*Until now, icons
have been static and inert.*

*Now, using your favorite
icon editor and this utility,*

*you can animate them,
running up to 16 animations
at once.*

tor. In addition to the editors mentioned in the outset, any number of public domain icon editors are available for downloading from various bulletin boards.

In selecting a suitable icon editor, look for two things: the ability to draw an icon transparently, that is, without a background of its own; and the ability to save the drawn image under a filename, move the entire image a few pixels and save it under a new filename, move it and save it again, and so on. This will eliminate the need to redraw the entire icon for each frame of the animation sequence.

As illustrated by the bouncing ball sequence shown in Figure 1, you might begin your frame sequence by creating an image with the ball at the top of the editing area. Save this first frame as

BALL1.ICO. The next frame, to be saved as BALL2.ICO, will use the same image, but this time it will be drawn two pixels lower, and so on, until the ball reaches the bottom of the editing area. (Typically, the editing area is 32 by 32 pixels overall.) If the ball is only to bounce up and down, you can then re-use your previously drawn icons in reverse order to show the ball traveling back up to the top of the frame.

Including a numeral as part of each .ICO filename will help you keep their order straight when you are ready to put them into an animation sequence (an .ANM script file) for ICON ANIMATOR to run. To get you started, I've included the .ICO and .ANM files for the bouncing ball as part of the self-extracting archive you download from PC MagNet.

USING ICON ANIMATOR After downloading ANIMATOR.EXE, copy it to the drive and directory from which you want to access it under Windows. There are several ways to run the program. As with most Windows applications, you can run

Top 10 Utilities

Rank	Utility
1	DIRMATCH - Compare 2 directories
2	BAT2EXEC - Batch file compiler
3	CHKFRAG - Checks fragmentation
4	PCSPPOOL - Print spool utility
5	INCTRL - Installation control
6	BUGS - Windows 3.1 screen saver
7	STRINGS - Enhance batch files
8	WPRINT - Print in Windows 3.1
9	CLIPST - Extend the clipboard
10	PCREM2 - Access a remote PC

This list is based on the total number of downloads each utility has had on PC MagNet over the past 12 months. To download these files, type GO ZNT:TIPS.

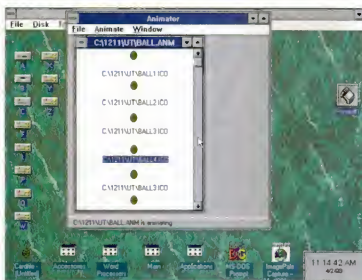


Figure 1: These sample frames (.ICO files) and the script (an .ANM file) for ICON ANIMATOR to run them can be downloaded as part of ANIMAT.ZIP.

it using the File | Run menu selections. If you don't want ICON ANIMATOR to start up automatically, you can put it in any group you wish. Since you'll probably want some of your regular programs to use animated icons automatically, however, you'll normally install ANIMATOR in your Startup Group.

To do this, simply highlight the Startup Group in Program Manager, select the File | New menu command, choose Program Item, and click OK. Fill in an icon title (in this case, *Animator* would be the obvious choice) in the Description edit box, and enter the complete path and executable filename on the Command Line. As your working directory, specify the directory in which you keep ANIMATOR's frame (.ICO) and script (.ANM) files. Finally, you'll want to check the Run Minimized box so that ANIMATOR won't come up atop your Program Manager each time you start Windows.

Once you have installed the utility and produced a series of images with your icon editor, you're ready to use ANIMATOR to create a script (.ANM) file. When you run ANIMATOR and choose File | New, an <Untitled> window will appear. Select Animation and choose Append Icon To End Of List. ICON ANIMATOR will now display a File Selection dialog box that contains your working directory. Double-click on the .ICO file that contains the image that you want to place first in your animation

sequence (BALL1.ICO, for example). ICON ANIMATOR will display this file—complete with image and full pathname—in the window in which your script file is being created.

If you should decide to add a second image to your animation sequence (BALL2.ICO, for instance), simply repeat the process: Choose **Animate**, then select **Append Icon To End Of**

List, double-click on the correct .ICO file, and ANIMATOR will display it in the <Untitled> window as the second item.

Either during or after creation of an .ANM script, you may find it necessary to make editing changes. If you need to edit a script you have already created, simply select File | Open. ICON ANIMATOR will present a list of all the .ANM files in your working directory. Double-click on the script you want to edit and ANIMATOR will display it in the window. Obviously, if you're in the process of creating a script, it will be displayed already.

Suppose, for example, that after correctly making BALL1.ICO the first frame in your sequence, you accidentally

skip BALL2.ICO and make BALL3.ICO the second frame in the sequence. If you double-click on BALL3.ICO to highlight it, and you then select Insert Icon into List from the Animate menu choices, you'll be able to repair your omission. To remove an icon frame file from the list, simply highlight it and select Delete Icon from List from the Animate menu.

ICON ANIMATOR also supports the File Manager's drag-and-drop protocol as an alternate way to insert or append icons. To insert an icon or a list of icons into a specific position, select the file(s) from File Manager (either with the mouse or by choosing File | Select Files), and drag the file atop the desired position in the icon script list. Dragging past the end of the list and releasing the left mouse button appends the file to the end of the list.

After your list of frame filenames is complete, you have but two remaining tasks. First, you must specify the *frame rate*; that is, the time interval to be inserted between frames. Second, you must associate the animation sequence with an application. You execute both these configuration options by selecting Settings from the Animate menu. The default time interval between frames is 100 milliseconds, but you can choose any value between 20 and 20,000 ms.

There are two ways to associate or link an animation sequence to an application. If the application is already running, press the **Link to Running Task** button:

BALL.ANM
Complete Listing

```
[Info]
; 100 milliseconds between frame switches.
TimerInterval=20
; Number of icons below.
NumIcons=6
; Automatically animate upon opening if LinkFile is running
AutoAnimate=1
; File to link animation to.
LinkFile=G:\WIN\NOTEPAD.EXE
;
;
[Icons]
IconFrame1=G:\WIN\PC\BALL1.ICO
IconFrame2=G:\WIN\PC\BALL2.ICO
IconFrame3=G:\WIN\PC\BALL3.ICO
IconFrame4=G:\WIN\PC\BALL4.ICO
IconFrame5=G:\WIN\PC\BALL3.ICO
IconFrame6=G:\WIN\PC\BALL2.ICO
```

Figure 2: ICON ANIMATOR uses this file to animate the bouncing ball icons. Note that in the [Icons] section the pathname should be changed to reflect the directory in which you keep your .ICO and .ANM files.

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The NotifyProc Callback Function

```

////////////////////////////////////
// NotifyProc() - Everytime TOOLHELP determines that a task is
// exiting or starting, it notifies ANIMATOR via this callback function.
// ANIMATOR immediately posts the message to get the condition into the
// queue of a window.
////////////////////////////////////

BOOL _export CALLBACK NotifyProc (WORD wID, DWORD dwData)
{
    switch (wID)
    {
        case NFY_EXITTASK:
        {
            PostMessage (_hwndFrame, WM_COMMAND, IDN_EXITTASK, 0L);
            break;
        }

        case NFY_STARTTASK:
        {
            PostMessage (_hwndFrame, WM_COMMAND, IDN_NEWTASK, 0L);
            break;
        }

        default:
            return FALSE;
    }
    return TRUE;
}

```

Figure 3: ICON ANIMATOR is notified, via this callback function, when a task is starting or exiting.

otherwise, press Link to an Executable File. Your choice will be displayed to the right of the words Linked to File. To avoid losing the linkage when ANIMATOR is closed, you should also check the Automatically Animate check box.

After you have linked an animation sequence to an application, you can see it work by selecting Go! from the Animate menu and then minimizing the application. At this point, however, your script has not yet been saved, so don't choose File | Close. Rather, select the File | Save (or File | Save As if you want a new filename for your script) to record what you have done.

The Stop and Go! choices on the Animate menu form a toggle whose status is reflected by the status bar at the bottom of the main ANIMATOR window. ICON ANIMATOR also has a Window drop-down menu that contains the standard Cascade, Tile, Arrange Icons, and Close All selections. It also shows the command line for all open ANIMATOR windows. Selecting a script window title in the menu activates that specific script.

Once you have prepared the animation scripts, add the ones you want to use regularly to the ANIMATOR Command Line as parameters. To do this, simply highlight ANIMATOR in your Startup

Group, select File | Properties from the Program Manager menu, and add the animation script filenames to the Command Line. For example, if you keep ICON ANIMATOR and its related files in the PCMTILS subdirectory of your Windows directory on drive C:, enter

```
C:\WINDOWS\PCMTILS\ANIMATOR.EXE
BALL.ANM
```

on the Command Line. To load more than one script, just enter it thus:

```
C:\WINDOWS\PCMTILS\ANIMATOR.EXE
BALL.ANM BELL.ANM
```

Note: In order for any program you run to have its icon replaced with its animating icon automatically, you *must* put the script file on the command line as a parameter.

INSIDE ICON ANIMATOR Although the user works with ANIMATOR primarily as if it were a simple script editor, to execute its tasks the utility needs timers, notification callbacks, owner-draw list box manipulation, and window enumeration. For example, the user can simply open an animation script that will automatically animate when its linked executable is loaded. As detailed more fully below,

to accomplish this ICON ANIMATOR must call the TOOLHELP NotifyRegister() function to install a notification callback, which signals when a task starts or exits.

My first version of ANIMATOR simply listed the full pathname and filename of each icon added or inserted into the list. After some consideration, however, the desirability of displaying the icons that make up the script made me decide to maintain an owner-draw list box. Having this list box control in the client window of each script meant adding a handler for the WM_DRAWITEM and WM_MEASUREITEM messages. The rest of the code concerned with the list box—such as the selection notification (receiving the LBN_SELCHANGE message) and insertion/deletion of items (sending the LB_ADDSTRING and LB_INSERTSTRING messages) from the list box—turned out to be the same as for a non-owner-draw list box.

Although ICON ANIMATOR has to be able to time multiple animation sequences, the use of a single timer was the most efficient way to go. (The SetTimer() function is discussed extensively below.) Windows has a limited number of timer events available to the system, so it is imperative that ANIMATOR be aware of the fact that its purpose is to run in conjunction with up to 16 other applications. I chose 16 thinking that this would probably be enough for most people and because supporting more would overtax the system. (ICON ANIMATOR itself is a one-instance application. If it were not, you could all-too-easily overload your system with multiple groups of 16 animations.)

When each animation script is opened, the animation's ANIMSTRUCT (the attached data structure that keeps track of its settings) receives a countdown value that is initially set to the user-selected frame rate (the interval between frames of the animation sequence). Every time the timer fires off an event to the ANIMATOR timer callback, it decrements this countdown value by the amount of time elapsed between events. When this countdown reaches zero, ICON ANIMATOR changes the icon in the class data structure for the application and invalidates all of the in-

The TimerCallback() Function

```
#include "animator.h"

static char szClass1[32];
static char szClass2[32];

HICON NEAR PASCAL GetNextIcon (short);
VOID NEAR PASCAL DrawIconic (HWND hWnd, HICON hIcon);

// TimerCallback() - this function is called by the timer, which fires
// off every twenty milliseconds (or close to that). It is not exact
// since Windows is message-driven. It steps through the animstruct
// and figures out whether or not it is worthy of animation, and if it
// and the user has chosen "Go!", then it decrements a time counter.
// When this time counter has reached 0 or less, we re-initialize the
// counter and change the icon. This way, all of the animations
// currently animating can use one timer.

VOID _export CALLBACK TimerCallback (HWND hWnd, UINT uMsg,
    WPARAM wParam, LPARAM lParam)
{
    short i;

    // For all eight possible animation sessions...
    for (i=0; i<MAXANIMATIONS; i++)
    {
        if (!IsWindow(hWndAnim(i)) || !ISANIMATING(i) || !HNDTARGET(i))
        {
            continue;
        }
        // If the countdown is at 0...display the next icon:
        if (!COUNTDOWN(i))
        {
            HICON hIcon = GetNextIcon(i);

            SetClassWord (HNDTARGET(i), GCW_HICON, hIcon);
            InvalidateAll (HNDTARGET(i), hIcon);
            SET_COUNTDOWN (i, TIMEINT(i)-(TIMEINT(i)&MINTIME));
        }
        // Otherwise, decrement the countdown by MINTIME amount.
        else
        {
            SET_COUNTDOWN (i, COUNTDOWN(i)-MINTIME);
        }
    }

    // GetNextIcon() - shifts through the list of icons.
}

HICON NEAR PASCAL GetNextIcon(short i)
{
    if (HICON(i)[INDEX(i)+1] == (HICON)NULL)
    {
        SET_INDEX (i, 0);
    }
    else
    {
        SET_INDEX (i, INDEX(i)+1);
    }
    return HICON(i)[INDEX(i)];
}

// InvalidateAll() - Enumerates the sibling instances of a module that
// is loaded, making all of the instances invalidate themselves.

VOID WINAPI InvalidateAll (HWND hWnd, HICON hIcon)
{
    HWND hWndNext;

    if (!IsWindow(hWnd)) return;

    GetClassName (hWnd, (LPSTR)szClass1, sizeof(szClass1));

    for (hWndNext = GetWindow(hWnd, GW_HWNDNEXT);
        hWndNext;
        hWndNext = GetWindow(hWndNext, GW_HWNDNEXT))
    {
        GetClassName (hWndNext, (LPSTR)szClass2, sizeof(szClass2));
        if (lstrcmp ((LPSTR)szClass1, (LPSTR)szClass2) == 0)
        {
            DrawIconic(hWndNext, hIcon);
        }
    }

    // window to redraw its non-client.

    VOID NEAR PASCAL DrawIconic (HWND hWnd, HICON hIcon)
    {
        if (!IsIconic(hWnd))
        {
            RedrawWindow (hWnd, (LPRECT)NULL, (HBRUSH)NULL,
                RDW_ERASE|RDW_FRAME|RDW_INTERNALPAINT|RDW_INVALIDATE);
        }
    }
}
```

Figure 4: The TimerCallback() function and its supporting functions, GetNextIcon(), InvalidateAll(), and DrawIconic(), handle all timer events in ICON ANIMATOR.

stances currently minimized. Every instance has in its class data structure an entry that stores a handle to an icon image to be displayed when the application is minimized. ICON ANIMATOR uses the SetClassWord() function to change the icon handle for the application:

```
SetClassWord (HNDTARGET(i),
    GCW_HICON, hIcon);
InvalidateAll (HNDTARGET(i), hIcon);
SET_COUNTDOWN (i, TIMEINT(i)
    -(TIMEINT(i)&MINTIME));
```

Once ICON ANIMATOR finishes its drawing, it resets the countdown back to the timer interval quantity that is specified by the user. The code above shows the entire contents of the timer callback function.

GETTING/SETTING WINDOW BYTES When programming a Windows application that supports MDI, window extra bytes can be very valuable. In ICON ANIMATOR, 6 extra bytes are specified in MAIN.C to store the list box window handle, an integer indicating the window number, and a Boolean used when the user saves the animation. WW_HWNDLIST, WW_WINDOWNUM, and WW_ISDIRTY, respectively, specify the offsets into the extra window byte area used to store these three values.

In the WinMain() function, when you register application-specific classes, you will notice that one of the fields in the WNDCLASS data structures is named cbWndExtra. This is an integer that specifies the number of bytes it should allocate following the window structure (in-

ternal to Windows). This area is conventionally used by the application to store window-specific data. To access the byte values allocated, use a positive byte offset as the index, starting at 0 for the first byte and extending upward in value. ANIMATOR allocates 6 bytes, or three words, for each MDI child window created. All values stored are words. The GetWindowWord(hWnd, nIndex) and SetWindowWord(hWnd, nIndex, wNewWord) functions are then used to get and set these values, specific to each MDI child window. For instance, any time a user alters anything in the current animation, ANIMATOR sets the value at offset WW_ISDIRTY to TRUE. When the user tries to close ICON ANIMATOR, it checks WW_ISDIRTY by calling GetWindowWord (hWnd, WW_IS-

DIRTY), and displays a message box if the return value was TRUE, asking the user if he or she wants to save the changes.

When an application calls `CreateWindow()` and creates a new window based on a previously registered class, Windows allocates a block of memory to store the information about the individual window. This memory block, or structure, is accessed by the `GetWindowWord()` and `SetWindowWord()` functions. The index value specified accesses a part of the structure (as defined in `WINDOWS.H` included with the SDK):

Identifier	Index
<code>GWW_HWNDPARENT</code>	-8
<code>GWW_INSTANCE</code>	-6
<code>GWW_WNDPROC</code>	-4
window extra bytes	8+ as defined

■ Utilities by Modem

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To obtain the current issue's utility free of charge: Dial the local number; at the HOST NAME prompt, type CIS; and at the USER ID prompt, enter 60116,1. Then at the PASSWORD prompt, enter PCMAG UTIL.

To join ZiffNet: At the USER ID prompt, type 177000,5000. Then, at the PASSWORD prompt, enter PC* MAGNET. Finally, at the ENTER AGREEMENT NUMBER prompt, type PCMAG93.

The window extra bytes that are defined by the programmer start at 0. Those that are defined in each window class by Windows have negative values, however. For the record, the long values start after `GWW_HWNDPARENT` and decrease by 4 instead of by 2 (words are 2 bytes, longs are 4 bytes). `GetWindowLong()` and `SetWindowLong()` return long values that correspond to the specified index.

FILE I/O USING .INI FUNCTIONS Instead of storing animation script information in binary format, I chose to implement ANIMATOR with profile file I/O (that is, as an .INI file) in order to illustrate its portability and ease of use. Windows supplies the `GetPrivateProfileInt()`, `GetPrivateProfileString()`, and `WritePrivateProfileString()` functions for all .INI-based file I/O. Each function reads and writes from a private .INI file. This means

that the application calling it provides its own file name. Functions of the same name without the Private read and write to the general WIN.INI file.

Each animation script file contains the

***TOOLHELP.DLL opens
up considerable
functionality and
publicizes a number of
undocumented functions.***

frame rate, whether or not `AutoAnimate` is active, the linked executable file name, the number of icons in the animation, and a list of the icon path and filenames of each icon in the animation. Figure 2 shows the contents of `BALL.ANM` and how the profile strings are defined.

ICON ANIMATOR also saves its current position on the desktop when it is closed. It does this in `MAIN.C` by calling the `GetWindowPlacement()` function, which fills a `WINDOWPLACEMENT` structure. (Note that the call will fail if you do not fill the length element in the `WINDOWPLACEMENT` data structure before calling the `GetWindowPlacement()` function. This should be, but is not, documented in the Windows 3.1 SDK.) The information in this structure is written to the `Position=` keyname under the [Animator] section of the `WIN.INI` file. The `WINDOWPLACEMENT` structure contains such information as state of the window, x and y position when minimized, x and y position when maximized, and window rectangle of the window when in restored state.

CREATING A NOTIFICATION CALLBACK `TOOLHELP.DLL` opens up considerable functionality and publicizes a number of previously undocumented functions. It contains functions that provide information about tasks, memory objects, classes, and modules. Among its many useful functions, two are of direct interest to ANIMATOR: `NotifyRegister()` and `NotifyUnRegister()`. (The Windows 3.1 SDK contains a full explanation of these functions.) The following shows how the callback function is registered:

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The FrameProc Function

```

////////////////////////////////////
// FrameProc() - a good example of how Message Crackers may be used.
// It intercepts messages, handles the ones used by ANIMATOR, and
// sends the rest to DefWndProc().
////////////////////////////////////

LRESULT _export CALLBACK FrameProc (HWNDPROC_PARAMS)
{
    switch (uMsg)
    {
        HANDLE_MSG (hwnd, WM_CREATE,      FrameOnCreate);
        HANDLE_MSG (hwnd, WM_INITMENU,    FrameOnInitMenu);
        HANDLE_MSG (hwnd, WM_COMMAND,     FrameOnCommand);
        HANDLE_MSG (hwnd, WM_SIZE,        FrameOnSize);
        HANDLE_MSG (hwnd, WM_CLOSE,       FrameOnClose);
        HANDLE_MSG (hwnd, WM_DESTROY,     FrameOnDestroy);
    }

    return (LRESULT)DefFrameProc(hwnd, _hwndClient, uMsg, wParam, lParam);
}

```

Figure 5: This function illustrates the simplicity of using Message Crackers.

```

lpfn = MakeProcInstance (NotifyProc,
    _hInst);
if (lpfn != NULL)
{
    NotifyRegister (NULL, NF_NORMAL);
}

```

You specify the task handle with which to associate the callback as the first parameter; NULL sets it to the current task. NotifyProc() is the application-supplied callback function that is activated when a task terminates or is created. The third parameter simply specifies that you want to receive normal default notification messages. Figure 3 illustrates what ANIMATOR does in the callback function. Whenever a task is created or destroyed,

a message is posted to ANIMATOR's frame window that indicates whether a task has been created or has terminated.

INSTALLING THE SYSTEM TIMER In order to install a system timer, the SetTimer() function is called. Either the application receives a message in its window procedure or a callback function can be installed. The syntax is as follows:

```

UINT SetTimer(hwnd, idTimer,
    uTimeout, tmprc)

```

The window handle to receive the message is hwnd, and idTimer is an ID value that SetTimer() uses to identify your timer event. SetTimer() also returns this value if the function was successful.

When ICON ANIMATOR is exiting, it calls the KillTimer() function with the window handle of the calling program and the idTimer number. The uTimeout value represents the amount of time, in milliseconds, between timer events. It is here that ICON ANIMATOR passes what I have called the frame rate; that is, the Timer Interval the user specifies by selecting the Animate | Settings command. The tmprc parameter is the procedure-instance address of the callback that will process the timer event. (MakeProcInstance() must be called in order to install the procedure instance). Figure 4 shows the callback that ICON ANIMATOR uses to respond to timer events.

MESSAGE CRACKERS Message Crackers, which replace the enormous switch statement normally found in a window callback function with a set of well-defined functions, are an excellent way to organize and simplify Windows code. Using Message Crackers will also make your applications compatible with the Win32 API. The heart of this new way of programming is in WINDOWSX.H, which contains all definitions needed to implement Message Crackers. Simply

```

#include <windows.h>
...
#include <windowsx.h>
...

```

and you have access to all its facilities.

A very good way to see what WIN-

The Child_OnMeasureItem and Child_OnDrawItem Functions

```

////////////////////////////////////
// Child_OnMeasureItem() - tells Windows how to size the list box.
////////////////////////////////////

LONG NEAR PASCAL Child_OnMeasureItem (
    HWND hwnd, LPMEASUREITEMSTRUCT lpms)
{
    lpms->itemHeight = GetANSITextHeight() + ICON_DY + PADDING;
    return 0L;
}

////////////////////////////////////
// Child_OnDrawItem() - Does the primary drawing for each item in the
// listbox, and calls the HandleFocusState() and HandleSelection()
// functions as necessary.
////////////////////////////////////

LONG NEAR PASCAL Child_OnDrawItem (
    HWND hwnd, const DRAWITEMSTRUCT FAR * lp)
{
    short sChild = WINDOWNUM(hwnd);
    if ((lp->CtlType == ODT_LISTBOX) && (lp->CtlID == IDD_LISTBOX))
    {
        if (HWNICONS(sChild) == 0)
        {
            return 0L;
        }
        return 0L;
    }
    return 0L;
}

```

Figure 6: These two functions tell Windows how to draw and size each list box entry.

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DOWNSX.H has to offer is to study the file WINDOWSX.TXT in the Windows SDK. There you will find:

- kernel macro APIs to manipulate far pointers;
- GDI macros to manipulate pens, regions, brushes, fonts, and bitmaps;
- user macros to manipulate windows and dialog boxes;
- macros for handling and forwarding all documented Windows messages passed to a window procedure (these are the Message Crackers); and
- macros for sending messages to Windows-supplied controls.

*Message Crackers provide
a seamless transition to
changes in parameter-
passing methods to window
procedures, separating
message-handling code into
neat, organized functions.*

Figure 5 shows a good example of how Message Crackers are used. Their main purpose is to provide a seamless transition from changes in parameter-passing methods to window procedures. At the same time, however, they separate your message handling code into neat, organized handler functions. The following is an example of the Message Cracker function prototype for the WM_COMMAND message:

```
VOID Cls_OnCommand(HWND hwnd, int  
id, HWND hwndCtl, UINT codeNotify);
```

This function shows the call the handler function makes for WM_COMMAND. Notice the Cls_ at the beginning of the function prototype. The WINDOWSX.TXT included with the Windows SDK file suggests that you replace this with the class name of the window that uses the handler.

The HANDLE_MSG() macro is the universal macro used for all messages in this window procedure. It is defined as:

```
#define HANDLE_MSG(hwnd,  
message, fn) \  
  
case (message): return  
HANDLE_#message( (hwnd) ,  
(wParam), (lParam), (fn))
```

You may not want to use HANDLE_MSG(), since it automatically returns the outcome of the handler. In that case, the following again uses WM_COMMAND as the example to illustrate what HANDLE_MSG() calls:

```
#define HANDLE_WM_COMMAND  
(hwnd, wParam, lParam, fn) \  
{ (fn) (hwnd), (int) (wParam),  
(HWND) LOWORD(lParam),  
(UINT) HIWORD(lParam)), 0L)  
  
#define FORWARD_WM_COMMAND  
(hwnd, id, hwndCtl, codeNotify, fn) \  
{ (void) (fn) (hwnd), WM_COMMAND,  
(WPARAM) (int) (id),  
MAKELPARAM((UINT) (hwndCtl),  
(codeNotify)) }
```

These macros simply call and forward a WM_COMMAND message to the specified handler function without returning anything. The hardest part of implementing them is converting all of your code over to this style!

THE OWNER-DRAW LIST BOX The owner-draw style of list box provides the programmer with an easy way to create a very user-friendly interface. Applications that contain dialog boxes listing files (such as you find among the Common Dialog Boxes supplied with Windows 3.1) contain little folderlike icons for the directories and drivelike icons next to the drives listed. This is a direct result of owner-list-box programming. The term *owner-draw* means that the owner of the list box is responsible for drawing each item in the list box. Figure 6 shows two Message Crackers that handle the drawing entirely: Child_OnDrawItem() and Child_OnMeasureItem().

When creating the list box, you must specify either LBS_OWNERDRAWFIXED or LBS_OWNERDRAWVARIABLE. If you select LBS_OWNERDRAWFIXED, all list box items will have the same height and Windows will call the Child_OnMeasure-

Item() once. This is how ICON ANIMATOR tells Windows to size the list of icons so that it fits the height of the icon image as well as the height of the text vertically. If I had specified LBS_OWNERDRAWVARIABLE, then Windows would call the Child_OnMeasureItem() separately for each and every list box item.

The Child_OnDrawItem() function is called each time an item gains or loses focus, each time an item is selected or unselected, and each time an item is drawn. Figure 6 demonstrates how ICON ANIMATOR handles each of the cases. Notice the second parameter to Child_OnDrawItem() is a far constant pointer to a DRAWITEMSTRUCT:

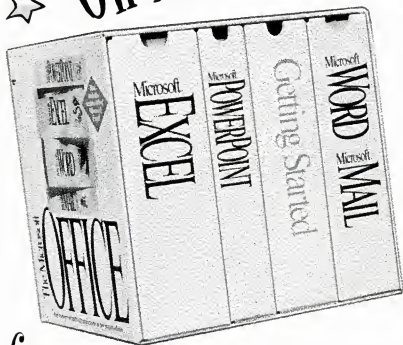
```
typedef struct tagDRAWITEMSTRUCT  
{  
    UINT CtlType;  
    UINT CtlID;  
    UINT itemID;  
    UINT itemAction;  
    UINT itemState;  
    HWND hwndItem;  
    HDC hDC;  
    RECT rcItem;  
    DWORD itemData;  
  
} DRAWITEMSTRUCT;
```

ICON ANIMATOR is particularly interested in the itemID, hDC, and rcItem members. The itemID member is used to retrieve the handle of the current icon to be drawn. The list box device context is specified by hDC; you do not need to get or release this device context. The rcItem member specifies a rectangle in the device context identified by the hDC member that defines the boundaries of the control to be drawn. For further information on the structure members and other uses and types of owner-draw controls, refer to the *Programmer's Reference of the Windows SDK*.

IN SUMMARY ICON ANIMATOR enables users to do something creative that they couldn't do before, and gives programmers useful Windows programming techniques. It livens up your desktop, making your work more fun. □

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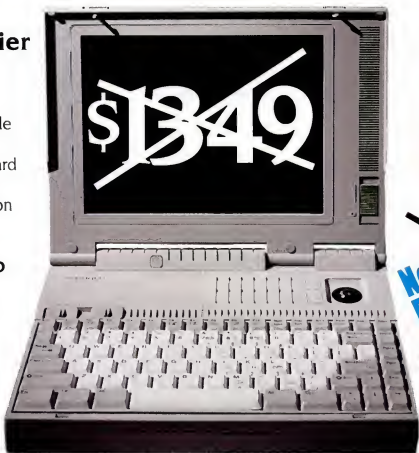
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CIRCLE 275 ON READER SERVICE CARD

OS/2 Paths and Fonts: The Versatile Connection

BY CHARLES PETZOLD

Every character in an outline font is defined by a series of straight lines and curves. Normally, when a graphics programming system displays text using outline fonts, it fills the areas defined by these lines to render the characters. However, some advanced graphics systems are able to use the character outlines for other purposes; for example, clipping.

This is an area where Microsoft Windows is currently weak. Despite the fact that Windows 3.1 introduced an outline font technology known as TrueType, the Windows Graphics Device Interface (GDI) does not include the necessary support to use TrueType fonts for anything much beyond displaying normal

text. As a compromise, Windows allows a program to access the lines and curves that compose each character in a TrueType font. But in order to get the tools necessary to use TrueType fonts in a truly versatile manner (such as matrix transforms and paths), you will have to wait for Windows NT.

The OS/2 Graphics Programming Interface (GPI), on the other hand, was designed from the ground up to support matrix transforms, paths, and outline fonts. The outline fonts included in OS/2 1.1 were not hinted fonts—which meant that they were quite illegible at small point sizes—but they were well-integrated with the other graphics features of GPI. With the hinted Adobe Type 1 outline fonts supported under OS/2 2.0, we get the best of both worlds.

In the last issue, I warned that using an outline font in a path could sometimes overflow the 64K segment limit for path storage in OS/2 2.0. This is a problem that should be fixed in OS/2 2.1. All the programs in this column work on a standard VGA with a maximized window. If you have a high-resolution display, the path creation functions may fail. If this happens, try reducing the size of the program's window.

Another problem is that some path operations can be quite slow. The only solution for that (other than buying a new machine) is to have a little patience when you're experimenting with the programs shown in this column.

PATHS AND FONTS In the last issue, I also discussed paths as implemented in OS/2. A *path* is a collection of line defini-

OLFFLINE.MAK and OLFFLINE.C

Complete Listing

A

```
#-----
# OLFFLINE.MAK Make file
#-----

olffline.exe : olffline.obj olfdemo.obj olf.obj olfdemo.def
link386 /BASE:0x10000 olffline olfdemo olf., NUL., olfdemo

olffline.obj : olffline.c olf.h
icc -C -Kbcp -Ss olffline.c

olfdemo.obj : olfdemo.c
icc -C -Kbcp -Ss olfdemo.c

olf.obj : olf.c olf.h
icc -C -Kbcp -Ss olf.c
```

B

```
/*-----
OLFFLINE.C -- Outlined OS/2 Outline Font
(c) Charles Petzold, 1993
-----*/

#define INCL_MIN
#define INCL_GPI
#include <os2.h>
#include <string.h>
#include "olf.h"

#define LCID_FONT 1

void PaintClient (HPS hps, SHORT cxClient, SHORT cyClient)
{
    static CHAR szText [] = "Hello!";
    POINTL ptl, aptl;
    TEXTBOX_COUNT;
}
```

```
// Create and size the logical font
CreateOutlineFont (hps, LCID_FONT, "Times New Roman Italic", 0, 0);
GpiSetCharSet (hps, LCID_FONT);
ScaleOutlineFont (hps, 1440, 1440);

// Get the text box
GpiQueryTextBox (hps, strlen (szText), szText,
    TEXTBOX_COUNT, aptl);

// Create the path
GpiBeginPath (hps, 1);

ptl.x = (cxClient - aptl.x) / 2;
ptl.y = (cyClient - aptl.y) / 2;
GpiCharStringAt (hps, &ptl, strlen (szText), szText);

GpiEndPath (hps);

// Outline the path
GpiSetLineWidth (hps, LINEWIDTH_THICK);
GpiOutlinePath (hps, 1, 0);

// Select the default font; delete the logical font
GpiSetCharSet (hps, LCID_DEFAULT);
GpiDeleteSetId (hps, LCID_FONT);
}
```

Figure 1: The Make file and source code for creating OLFFLINE.EXE.



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■ The Results of Using Paths and Fonts



By incrementally enhancing OLF.C, the programs presented here show how to draw an outlined font (A), an outlined font with a drop shadow (B), an outlined font with normal fonts underneath (C), a font both stroked and outlined with a modified path (D), a font with only an outlined modified path (E), a font both filled and outlined (F), and an outlined font drawn with Bezier splines (G).

tions stored internally in GPI. To create a path, you call line-drawing functions within a *path bracket*, which is delimited by calls to the `GpiBeginPath` and `GpiEndPath` functions. A Presentation Manager program can then use the path for outlining, stroking, filling, clipping, or converting to a region.

Outlining and stroking paths are in one way quite similar: In both cases, GPI

draws the path as a series of lines. But there the similarity ends. Creating an outlined path is basically the same as drawing the lines without using a path. The lines can have a style (such as being composed of dots and dashes) and a width. The width is limited to a normal width and a thick (that is, double) width. This is known as the *cosmetic* line width. It is not affected by any transforms that influ-

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OLDFROP.MAK and OLDFROP.C

Complete Listing

```

A
#-----
# OLDFROP.MAK Make file
#-----

olfdrop.exe : olfdrop.obj olfdemo.obj olf.obj olfdemo.def
link386 /BASE:0x10000 olfdrop olfdemo olf., /NUL., olfdemo

olfdrop.obj : olfdrop.c olf.h
lcc -C -Kbcp -Ss olfdrop.c

olfdemo.obj : olfdemo.c
lcc -C -Kbcp -Ss olfdemo.c

olf.obj : olf.c olf.h
lcc -C -Kbcp -Ss olf.c

```

```

B
/*-----
OLDFROP.C -- Drop Shadow OS/2 Outline Font
(c) Charles Petzold, 1993
-----*/

#define INCL_MIN
#define INCL_OPI
#include <os2.h>
#include <string.h>
#include "olf.h"

#define LCID_FONT 1

void PaintClient (HPS hps, SHORT cxClient, SHORT cyClient)
{
    static CHAR szText [] = "Hello!";
    POINTL ptl, aptl;
    aptl.x = ptl.x = TEXTBOX_COUNT;

    // Create and size the logical font
}

```

```

CreateOutlineFont (hps, LCID_FONT, "Times New Roman Italic", 0, 0);
GpiSetCharSet (hps, LCID_FONT);
ScaleOutlineFont (hps, 1440, 1440);

// Get the text box
GpiQueryTextBox (hps, strlen (szText), szText,
    TEXTBOX_COUNT, aptl);

// Display the font normally twice
ptl.x = (cxClient - aptl.x) / 2;
ptl.y = (cyClient - aptl.y) / 2;

GpiCharStringAt (hps, aptl, strlen (szText), szText);

ptl.x += 10;
ptl.y += 10;

GpiSetColor (hps, CLR_BACKGROUND);
GpiCharStringAt (hps, aptl, strlen (szText), szText);

// Create the path
GpiBeginPath (hps, 1);
GpiCharStringAt (hps, aptl, strlen (szText), szText);
GpiEndPath (hps);

// Outline the path
GpiSetColor (hps, CLR_NEUTRAL);
GpiSetLineDash (hps, LINEWIDTH_THICK);
GpiOutlinePath (hps, 1, 0);

// Select the default font; delete the logical font
GpiSetCharSet (hps, LCID_DEFAULT);
GpiDeleteSetId (hps, LCID_FONT);
}

```



Figure 2: The Make file and C source code for creating OLDFROP.EXE. OLDFROP.C uses a path to draw a drop-shadowed font.

OLFBLOK.MAK and OLFBLOK.C

Complete Listing

```

A
#-----
# OLFBLOK.MAK Make file
#-----

olfblok.exe : olfblok.obj olfdemo.obj olf.obj olfdemo.def
link386 /BASE:0x10000 olfblok olfdemo olf., /NUL., olfdemo

olfblok.obj : olfblok.c olf.h
lcc -C -Kbcp -Ss olfblok.c

olfdemo.obj : olfdemo.c
lcc -C -Kbcp -Ss olfdemo.c

olf.obj : olf.c olf.h
lcc -C -Kbcp -Ss olf.c

```

```

B
/*-----
OLFBLOK.C -- Blocked OS/2 Outline Font
(c) Charles Petzold, 1993
-----*/

#define INCL_MIN
#define INCL_OPI
#include <os2.h>
#include <string.h>
#include "olf.h"

#define LCID_FONT 1

void PaintClient (HPS hps, SHORT cxClient, SHORT cyClient)
{
    static CHAR szText [] = "Hello!";
    int i;
    POINTL ptl, aptl;
    aptl.x = ptl.x = TEXTBOX_COUNT;

    // Create and size the logical font
    CreateOutlineFont (hps, LCID_FONT, "Times New Roman Italic", 0, 0);
    GpiSetCharSet (hps, LCID_FONT);
}

```

```

ScaleOutlineFont (hps, 1440, 1440);

// Get the text box
GpiQueryTextBox (hps, strlen (szText), szText,
    TEXTBOX_COUNT, aptl);

// Display the font normally
ptl.x = (cxClient - aptl.x) / 2;
ptl.y = (cyClient - aptl.y) / 2;

for (i = 0; i < 16; i++)
{
    GpiCharStringAt (hps, aptl, strlen (szText), szText);

    ptl.x += 1;
    ptl.y += 1;
}

GpiSetColor (hps, CLR_BACKGROUND);
GpiCharStringAt (hps, aptl, strlen (szText), szText);

// Create the path
GpiBeginPath (hps, 1);
GpiCharStringAt (hps, aptl, strlen (szText), szText);
GpiEndPath (hps);

// Outline the path
GpiSetColor (hps, CLR_NEUTRAL);
GpiSetLineDash (hps, LINEWIDTH_THICK);
GpiOutlinePath (hps, 1, 0);

// Select the default font; delete the logical font
GpiSetCharSet (hps, LCID_DEFAULT);
GpiDeleteSetId (hps, LCID_FONT);
}

```



Figure 3: The Make file and C source code for creating OLFBLOK.EXE. OLFBLOK.C uses a path to draw a blocked font.



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OLFWIDE.MAK and OLFWIDE.C

Complete Listing

A

```

#-----
# OLFWIDE.MAK Make file
#-----

olfwide.exe : olfwide.obj olfdemo.obj olf.obj olfdemo.def
link386 /BASE:0x0000 olfwide olfdemo olf., NUL., olfdemo

olfwide.obj : olfwide.c olf.h
icc -C -Kbcrpr -Ss olfwide.c

olfdemo.obj : olfdemo.c
icc -C -Kbcrpr -Ss olfdemo.c

olf.obj : olf.c olf.h
icc -C -Kbcrpr -Ss olf.c

```

B

```

/*-----
OLFWIDE.C -- Wide-lined OS/2 Outline Font
(c) Charles Petzold, 1993
-----*/

#define INCL_WIN
#define INCL_GPI
#include <os2.h>
#include <string.h>
#include "olf.h"

#define LCID_FONT 1

void PaintClient (HPS hps, SHORT cxClient, SHORT cyClient)
{
    static CHAR szText [] = "Hello!";
    POINTL pti, Aptl;
    Aptl.x = 0;
    Aptl.y = 0;

    // Create and size the logical font
    CreateOutlineFont (hps, LCID_FONT, "Times New Roman Italic", 0, 0);
    GpiSetCharSet (hps, LCID_FONT);
}

```

```

ScaleOutlineFont (hps, 1440, 1440);

// Get the text box
GpiQueryTextBox (hps, strlen (szText), szText,
    TEXTBOX_COUNT, Aptl;
    TEXTBOX;

// Create the path
GpiBeginPath (hps, 1);

ptl.x = (cxClient - aptl.x) / 2;
ptl.y = (cyClient - aptl.y) / 2;

GpiCharStringAt (hps, &ptl, strlen (szText), szText);

GpiEndPath (hps);

// Stroke the path
GpiSetLineWidthGeom (hps, 10);
GpiSetPattern (hps, PATHSYTHATCH);
GpiStrokePath (hps, 1, 0);

// Create the path again
GpiBeginPath (hps, 1);
GpiCharStringAt (hps, &ptl, strlen (szText), szText);
GpiEndPath (hps);

// Modify and outline the path
GpiModifyPath (hps, 1, MPATH_STROKE);
GpiOutlinePath (hps, 1, 0);

// Select the default font; delete the logical font
GpiSetCharSet (hps, LCID_DEFAULT);
GpiDeleteSetId (hps, LCID_FONT);
}

```



Figure 4: The Make file and source code for creating OLFWIDE.EXE. OLFWIDE.C uses a path to draw a font with geometrically thick outlines.

ence the size of other graphical objects.

GPI draws a stroked path using a line with a *geometric* width. The geometric width can be as large as you want it to be, and it is affected by transforms. GPI fills cosmetic lines with the current area-filling pattern, and also allows you to specify different line ends and joins. Drawing geometric lines without using paths is not possible.

The connection between paths and outline fonts is very simple: When an outline font has been selected into a presentation space, you can call text output functions within the path bracket. The character outlines become part of the path.

OUTLINED CHARACTERS Let's try it. The OLFWIDE program shown in Figures 1(a) and 1(b) uses a path and the GpiOutlinePath function to draw outlined characters.

This program requires the OLF (outline font) files from the April 13, 1993, issue and the OLFDemo files from the April 27, 1993, issue. These files provide simplified outline font selections and the

normal Presentation Manager overhead necessary for demonstrating simple graphics. You will also need IBM's C Developer's WorkSet/2 installed to run NMAKE on the Make file and create OLFWIDE.EXE. Or, you can download all the files and executables for this program and all others mentioned in this column from the Programming forum on PC MagNet, where they are archived as OLFONT.ZIP.

The program begins by using the CreateOutlineFont and ScaleOutlineFont functions in OLF.C to create a Times New Roman Italic font and scale it to a 144 point size. It then uses GpiQueryTextBox to obtain the text box dimensions of the string "Hello!" This information is used to center the text string in the client window. The program begins the path bracket by calling GpiBeginPath, draws the character string by calling GpiCharStringAt, and ends the path bracket with GpiEndPath.

At this point, nothing has yet been drawn on the client window. OLF LINE.C calls GpiSetLineWidth to select

a thick line and then GpiOutlinePath to render the path on the window, as shown in Figure 4 in the "The Results of Using Paths and Fonts" sidebar. Of course, you can get the same effect without a path by using the FATTR_SEL_OUTLINE attribute when creating the font. However, if you want to use the normal filled font together with the outlined font, you will have to create two fonts. Using the path, you need only one.

A DROP-SHADOW FONT When drawing a text string with a drop shadow, for example, you need both a normal font and an outline font. In the May 11, 1993, issue I drew a font shadow using an abnormally tall font tilted to one side using the GpiSetCharShear function, creating the effect of a font standing perpendicular to the surface on which its shadow appears.

A drop shadow, on the other hand, makes the object appear as if it's suspended in front of the screen. By convention, such shadows are drawn as if the light source originates from the upper left corner of the video display.

The OLFDROP program shown in

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CIRCLE 139 ON READER SERVICE CARD



Figures 2(a) and 2(b) shows how to draw an outlined font with a drop shadow.

As in OLFLINE, the program creates a 144-point Times New Roman Italic font. The program then draws normal text centered in the client window. This is the shadow. The program switches to the background color by calling `GpiSetColor` with the `CLR_BACKGROUND` parameter. (By default, the background color is white, but it can be changed by the user.) The text is drawn again, offset 10 pixels from the left and bottom of the first text string. (This offset looks fine on a VGA, but in a real program you'll probably want to calculate the offset in a more device-independent manner.) This is the interior of the outlined font.

The program then creates a path containing the font outline, switches back to the foreground color using `GpiSetColor` with the `CLR_NEUTRAL` parameter (which indicates black by default), and calls `GpiOutlinePath`. The results are shown in Figure B of the sidebar.

Another approach to drawing a font with a three-dimensional appearance is shown in the OLBLOK program in Fig-

ures 3(a) and 3(b). This program is very similar to OLFDROP, but instead of drawing just one normal black font, it draws 16 of them, each progressively offset by 1 pixel to the left and 1 pixel up. This is capped by a normal white font, and then an outlined black font. The result is shown in Figure C of "The Results of Using Paths and Fonts" sidebar. The characters appear as if they are carved blocks.

STROKING THE FONT So far, we've been looking at the effects possible with outlining a path by calling `GpiOutlinePath`. You can also render the path by calling `GpiStrokePath`, which draws the path as a geometric thick line filled with the current area-filling pattern.

The OLFWIDE program in Figures 4(a) and 4(b) demonstrates this. As the previous programs do, it creates a 144-point Times New Roman Italic font and draws the "Hello!" text string within a path bracket. OLFWIDE then calls `GpiSetLineWidthGeom` to set the geometric line width at 10 pixels. (In a real program, you'd want to use a more device-independent approach to setting that width.)

The program then sets the area-filling pattern to `PATSYM_HATCH`—a pattern that is a series of horizontal and vertical lines—and calls `GpiStrokePath`. This renders the font outlines as a series of 10-pixel-wide lines filled with the `PATSYM_HATCH` pattern.

The OLFWIDE program then creates another path with the same text string and calls `GpiModifyPath`, which takes an existing path and replaces it with a new path that represents the outline of the geometrically thick line that would be rendered by calling `GpiStrokePath`. Thus, this modified path outlines the area pattern just drawn. The program finishes up by calling `GpiOutlinePath` to outline that pattern. The results are shown in Figure D of the sidebar.

To see the separate effects of stroking and outlining the modified path, you may want to comment out either the `GpiStrokePath` or `GpiOutlinePath` calls in OLFWIDE.C and recompile the program. In particular, if you remove the call to `GpiStrokePath`, you'll see the rather strange-looking display that is shown in Figure E of the sidebar.

OLDFILL.MAK and OLDFILL.C

Complete Listing

A

```
#-----
# OLDFILL.MAK Make file
#-----

oldfill.exe : oldfill.obj olddemo.obj oldfont.obj olddemo.def
link386 /BASE:0x10000 oldfill olddemo oldfont, nul, olddemo

oldfill.obj : oldfill.c oldfont.h
lcc -C -Xcprc -Ss oldfill.c

olddemo.obj : olddemo.c
lcc -C -Xcprc -Ss olddemo.c

oldfont.obj : oldfont.c oldfont.h
lcc -C -Xcprc -Ss oldfont.c
```

B

```
/*-----
 * OLDFILL.C -- Filled 10/2 Outlined Font
 * (c) Charles Petzold, 1993
 *-----*/

#define INCL_MIN
#define INCL_GPI
#include <os2.h>
#include <string.h>
#include "oldfont.h"

#define LCID_FONT 1

void PaintClient (HPS hps, SHORT cxClient, SHORT cyClient)
{
    static CHAR szText [] = "Hello!";
    POINT pt1, pt2;
    GpiSetCharSet (hps, LCID_FONT, "Times New Roman Italic", 0, 0);

    // Create and size the logical font
    CreateOutlineFont (hps, LCID_FONT, "Times New Roman Italic", 0, 0);
```

```
GpiSetCharSet (hps, LCID_FONT);
ScaleOutlineFont (hps, 1440, 1440);

// Get the text box
GpiQueryTextBox (hps, strlen (szText), szText,
    TEXTBOX_COUNT, pt1, pt2);

// Create the path
GpiBeginPath (hps, 1);

pt1.x = (cxClient - apt1TextBox [TEXTBOX_COUNT].x) / 2;
pt1.y = (cyClient - apt1TextBox [TEXTBOX_COUNT].y
    - apt1TextBox [TEXTBOX_COUNT].y) / 2;

GpiCharStringAt (hps, &pt1, strlen (szText), szText);

GpiEndPath (hps);

// Fill the path
GpiSetPattern (hps, PATSYM_HATCH);
GpiFillPath (hps, 1, 0);

// Create the path again
GpiBeginPath (hps, 1);
GpiCharStringAt (hps, &pt1, strlen (szText), szText);
GpiEndPath (hps);

// Outline the path
GpiOutlinePath (hps, 1, 0);

// Select the default font; delete the logical font
GpiSetCharSet (hps, LCID_DEFAULT);
GpiDeleteSetId (hps, LCID_FONT);
1
```



Figure 5: The Make file and source code for creating OLDFILL.EXE. OLDFILL.C uses a path to draw a filled and outlined font.

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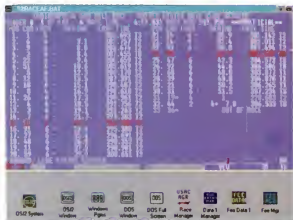


entry fees, qualifying times and speeds to engine serial numbers and driver and crew information. Then all the data collected dur-

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OLFCLIP.MAK and OLFCLIP.C

Complete Listing

```

A
# OLFCLIP.MAK Make file
#
olfclip.exe : olfclip.obj olfdemo.obj elf.obj olfdemo.def
link386 /BASE:0x10000 olfclip olfdemo elf, /NUL, /olfdemo
olfclip.obj : olfclip.c elf.h
icc -C -Kbcp -Ss olfclip.c
olfdemo.obj : olfdemo.c
icc -C -Kbcp -Ss olfdemo.c
elf.obj : elf.c elf.h
icc -C -Kbcp -Ss elf.c

```

```

B
/*
OLFCLIP.C -- OS/2 Outline Font Clipping
(c) Charles Petzold, 1993
*/

#define INCL_WIN
#define INCL_GPI
#include <os2.h>
#include <string.h>
#include "elf.h"

#define LCID_FONT 1

void PaintClient (HPS hps, SHORT cxClient, SHORT cyClient)
{
    static CHAR szText[] = "Hello!";
    int i;
    POINTL pti, aptl[3], aptlTextBox[TEXTBOX_COUNT];

    // Create and size the logical font.
    CreateOutlineFont (
        hps, LCID_FONT, "Times New Roman Italic", 8, 8);
    GpiSetCharSet (hps, LCID_FONT);
    ScaleOutlineFont (hps, 1448, 1448);

    // Get the text box

```

```

GpiQueryTextBox (hps, strlen (szText), szText,
    TEXTBOX_COUNT, aptlTextBox);

    // Create the path
    GpiBeginPath (hps, 1);

    pti.x = (cxClient - aptlTextBox[TEXTBOX_CONCAT].x) / 2;
    pti.y = (cyClient - aptlTextBox[TEXTBOX_TOPLEFT].y
        - aptlTextBox[TEXTBOX_BOTTOMLEFT].y) / 2;

    GpiCharStringAt (hps, aptl, strlen (szText), szText);

    GpiEndPath (hps);

    // Set the clipping path
    GpiSetClipPath (hps, 1, SCP_AND | SCP_ALTERNATE);

    // Draw Bezier splines
    for (i = 0; i < cyClient; i++)
    {
        GpiSetColor (hps, (i / 16) * 6 + 1);

        pti.x = 0;
        pti.y = i;
        GpiMove (hps, pti);

        aptl[0].x = cxClient / 3;
        aptl[0].y = i + cyClient / 3;

        aptl[1].x = 2 * cxClient / 3;
        aptl[1].y = i - cyClient / 3;

        aptl[2].x = cxClient;
        aptl[2].y = i;

        GpiPolySpline (hps, 3, aptl);
    }

    // Select the default font; delete the logical font
    GpiSetCharSet (hps, LCID_DEFAULT);
    GpiDeleteSetId (hps, LCID_FONT);
}

```



Figure 8: The Make file and source code to create OLFCLIP.EXE. OLFCLIP.C uses a path for clipping Bezier spline curves.

We saw some of this oddness in the PATHS program in the last issue: When two lines in the path are joined at an angle, the modified path often has a little interior loop. You'll also notice little lines in the interior of the path where the path curves. These are results of GPI's area-filling algorithm, and I'm afraid you'll see similar weirdness in the path implementation in Windows NT.

FILLING THE PATH The third function that uses a path is called GpiFillPath, and as the name implies, it fills the interior of the path using the current area-filling pattern. This is different from GpiStrokePath, which strokes the path using the area-filling pattern.

However, the GpiFillPath and GpiStrokePath functions are related: GpiStrokePath is equivalent to GpiModifyPath followed by GpiFillPath. IBM's *Presentation Manager Programming Reference* indicates that GpiStrokePath "is provided to enable device drivers to opti-

mize storage, if possible." What happens is that GpiModifyPath greatly increases the storage necessary to store the path. A device driver might be able to implement GpiStrokePath without requiring that additional storage.

Anyway, let's look at a sample program called OLFILL, shown in (Figures 5(a) and 5(b)). The program is similar to OLFWIDE, but less complex. The program creates the path twice. With the first path, OLFILL sets the area-filling pattern to PATSYM_HATCH and calls GpiFillPath. After creating the second path, the program calls GpiOutlinePath. The results (obviously more normal-looking than the OLFWIDE display) are shown in Figure F in "The Results of Using Paths and Fonts" sidebar.

PATHS AND CLIPPING When I first began learning graphics programming, the whole concept of clipping really mystified me. Most graphics programming environments support some type of clipping,

but I couldn't understand why it was considered so important in the total feature list of a graphics programming system.

Clipping is basically instructing the graphics programming environment to restrict drawing to a particular area of the display (either the video screen or the printer page). When you set a clipping area, you are actually telling the graphics system not to draw outside of that specified area. Any graphics object you subsequently draw appears only within the area you have set.

What mystified me about clipping is this: If you don't want to draw outside of a particular area, why not just avoid doing so?

Well, as every graphics programmer eventually learns, clipping is not usually necessary, but it is often very convenient. Clipping makes certain tasks much easier than they would be otherwise. For example, GPI prohibits you from drawing outside the window with which the presen-

tation space is associated. This is *very* convenient because you don't have to worry about drawing on another program's window.

Just as GPI supports several levels of coordinate transforms, GPI also supports several levels of clipping. However, by far the most versatile clipping involves paths. After you create a path, you can use the path as a clipping area simply by calling the following:

```
GpiSetClipPath (hps, lPath,
    lOption);
```

To set the clipping path, the lPath parameter must be equal to 1, as is normal with the path functions. The lOption parameter can be a combination of identifiers defined in PMGPI.H beginning with the prefix SCP. These identifiers are defined like so:

```
#define SCP_ALTERNATE 0L
#define SCP_WINDING 2L
#define SCP_AND 4L
#define SCP_RESET 0L
#define SCP_EXCL 0L
#define SCP_INCL 8L
```

Unfortunately, only the first two constants are documented in IBM's programming references. These determine how interiors of intersecting paths are handled, as I discussed in the last installment of this column. However, you also need to include SCP_AND when setting the clipping path. This causes the area defined by the path to be intersected by the current clipping path. To reset the presentation space to prohibit clipping, use a 0 value for the lPath parameter and an SCP_RESET value (also equal to 0) for the lOption parameter. Unfortunately, I have not been able to determine exactly what it is that SCP_EXCL and SCP_INCL are supposed to do.

The OLFCLIP program in Figures 6(a) and 6(b) shows an example of using an outline font for clipping. The program uses the same path we've been using, but after calling the GpiSetClipPath function, it draws a series of colored Bezier splines. The results are shown in Figure G of the sidebar.

POSSIBLE OTHERWISE? Earlier in this discussion, I mentioned that clipping is

not often absolutely necessary when you're working with graphics. I originally wanted to substantiate that statement by showing how to create a display identical to OLFCLIP without using paths or clipping.

The approach I took was this: The program begins by drawing the Bezier splines throughout the client window. Then, after selecting the outline font in the presentation space and determining the dimensions of the text box, the program sets the color to CLR_BACKGROUND and uses GpiBox to effectively erase the Bezier splines at the top, bottom, left, and right of the text box. So far, so good.

Then, the program sets the mix mode by calling GpiSetMix with the FM_LEAVE_ALONE parameter and the background mix mode by calling GpiSetBackMix with the BM_OVERPAINT parameter, and finally calls GpiCharStringAt. When I wrote this program, I was hoping that the area nor-

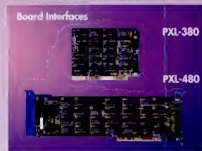
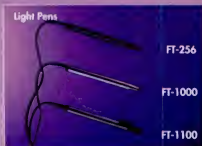
*As every graphics
programmer eventually
learns, clipping is
not usually necessary,
but it's often very
convenient.*

mally occupied by the font characters would be left alone, but the background of the characters (that is, the rectangular text box of each character) would be erased. This would have created a display identical to that shown in Figure G.

Well, I succeeded and I failed. What actually happens when you call GpiCharStringAt with the background mix set to BM_OVERPAINT is that GPI erases the entire character box, not just the area not occupied by the character. So, I was left with nothing. At any rate, even if it were possible to duplicate Figure G, the code would be more complex than the OLFCLIP program. That is certainly an advantage of paths and clipping. □

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Four Techniques to Enhance Your Windows Help Files

BY RAY DUNCAN

In the last three columns, we've looked at the process of designing and implementing a simple Windows help file, using the EXE-LOOK utility from three earlier Power Programming columns as an example (the February 9, March 16, and March 30, 1993, issues). In this installment, we'll cover a few more specialized techniques that you can use to enhance your help files.

PERVASIVE HYPERLINKS As you'll remember from our earliest discussions of help file construction, the source files that are fed to the help file compiler are based on three fundamental types of objects: topics, context strings, and hyperlinks.

A help file topic is basically a chunk of information on a single subject. In a help source file, a topic is delimited by *hard page breaks* before and after. From the user's point of view, a topic is a unit of text that appears within a resizable window. The margins of the topic text are automatically adjusted, and the paragraphs of the text are reflowed to fit within the horizontal width of the window. If the reflowed text is too long to fit in the window, the help file viewer adds a scroll bar to the window and lets the user move backward and forward through the text of the topic at will.

A context string is, in programming terms, simply a label that is associated with a location in the help file source. A context string is associated with a topic by creating a footnote at the beginning of the topic, using the number sign (#) as the footnote indicator. The contents of the footnote are the context string or label that symbolically identifies the topic to the help file compiler.

A hyperlink is a *hot spot* in topic text as viewed by the user. When the mouse

cursor is situated directly over a hot spot, it changes to a hand symbol, and when the user clicks the mouse on the hot spot, the help file viewer jumps to another spot in the same (or another) help file. Hot spots can be implemented with either text or graphics, but text hot spots are the most common. From the help file author's perspective, text hot spots are created by double-underlining the text that will be clicked by the user, and by inserting the context string for the topic that is the destination of the hyperlink jump

*With the basics under
our belts, now let's
see how to spiff up
our Windows help files
with hyperlinks, pop-up
and secondary windows,
and bitmaps.*

as hidden text immediately after the underlined text. The hot spot text for ordinary hyperlinks is typically displayed to the user by the help file viewer in green with a solid single underline, although both of these properties can be overridden by the help file author.

In the first of my columns on help files, I showed you how to build a simple hierarchical help file structure where the topic that was first displayed to the user was formatted as a table of contents. The top-level table of contents then led, via hyperlinks, to other topics which were formatted as subsidiary or more detailed tables of contents, and those in turn brought the user via additional hyper-

links to the topics that contained the actual help text the user was looking for. Most help files, however, are only organized as such simple hierarchies in the earliest stages. As the help file evolves, additional words in the body of each topic are marked as hyperlinks to let the user jump back and forth through the help file to closely related topics, to display definitions, or to move quickly from more abstract discussions to more detailed explanations and vice versa. The final result is more like a dense mesh of hyperlinks than a tree structure.

Pervasive hyperlinks in the help file may be extremely helpful to the help file's user, but they represent an immense amount of manual labor for the help file author. Microsoft does not supply an integrated development environment for help source files that is savvy about hyperlinks—after all, the help source files are merely created in a word processor that knows how to format footnotes and export the RTF file format—so all hyperlinks must be built up by laboriously scanning the help file text, identifying useful cross-references, and then meticulously formatting the hot spots and inserting the hidden context strings for the hyperlink targets. The help file author must rely on naming conventions and a good memory or some jury-rigged context-string tracking system to resolve hyperlinks correctly the first time, so that not too much time will be wasted chasing help file compiler error messages.

POP-UP WINDOWS The default type of hyperlink that I have already described behaves in a very straightforward manner—the contents of the help file viewer's main window are immediately replaced by the text of the topic that is the destination of the hyperlink jump. Unfortunately, there are many circumstances where this sort of hyperlink is jarring and

not very convenient, such as when you simply want to display the definition of a word or a reference for a citation without causing the user to lose his help file context. For this reason, the help file system provides an alternative hyperlink behavior called a pop-up window.

A pop-up window is something like a child window and something like an application-modal dialog. It is nonresizable with a thin border, and it has a drop shadow to make it stand out with a three-dimensional appearance. A pop-up does not have a title bar, a menu bar, or a control menu. The pop-up appears near—usually immediately below—the hot spot that invokes it, and is dismissed when the user clicks anywhere on the screen. An example of a pop-up window is shown in Figure 1.

Creating a pop-up window in your help file source is easy. The topic that will be displayed in the pop-up window is formatted just like any other topic—delimited by hard page breaks and identified by a context string in a # footnote. The only thing that you need to do differently from the hyperlinks, in fact, is to format the visible text portion of the hyperlink with a single underline instead of a double underline. The help file viewer then displays this text to the help file user with a broken underline instead of a solid underline, using a default color of green.

Pop-up windows have some severe restrictions. The first and most important restriction is that only one pop-up window can be on the screen at a time. Moreover, if the user clicks on a hot spot within a pop-up, the pop-up instantly disappears to make way for the topic that is the tar-

get of the hyperlink, and it cannot be recalled with the help viewer's history list or Back button. Pop-up windows cannot be moved or resized by the user, cannot be scrolled, and their size is constrained by the main help viewer window. If the topic text will not fit within the pop-up window, it is simply clipped.

SECONDARY WINDOWS The help system supports another kind of window, called a secondary window, that is somewhat more flexible than a pop-up window. Secondary windows are full-fledged resizable movable windows, with a title bar, control menu, and (whenever it's appropriate) a scroll bar, which can be controlled by hyperlinks and can persist on the screen independent of the main help window. Secondary windows are distinguished visually from the main help window by their lack of a button bar or menu bar; an example can be seen in Figure 2.

Although secondary windows are highly useful, they require a fair amount of planning and setup, and extreme care in the creation of hyperlinks. You declare your intent to use a secondary window by adding an entry to the [WINDOWS] section of the help project (.HPJ) file that controls the compilation of the help file. This entry takes the form

```
window-name = "windowtitle",
(x, y, width, height),
window-state, [(scrollingRGB)],
[(non-scrolling RGB)], on-top-state
```

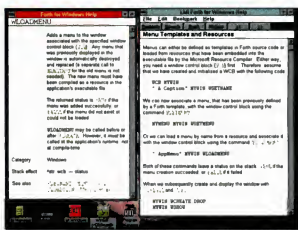


Figure 2: Secondary windows provide somewhat more flexibility than pop-ups, but they require far more planning to implement.

1,024 units regardless of the actual number of pixels. The *window-state* indicates whether the window is initially maximized, the *on-top-state* does what you would expect, and the optional *scrolling RGB* and *nonscrolling RGB* parameters can be used to control the background colors that will appear in the secondary window.

For example, the following entry in an .HPJ file would declare a secondary window type named *auxwin* that has a title bar containing "EXELOOK Auxiliary Help," is not maximized when it appears, does not stay on top, uses the default background colors for both scrolling and nonscrolling regions, and is initially positioned and sized to occupy the upper left quadrant of the screen:

```
auxwin = "EXELOOK Auxiliary Help",
(0, 0, 512, 512), 0, , , 0
```

When you create a hyperlink and want the topic that is the target of the hyperlink to be displayed in a secondary window rather than the main window, you simply append the character > and the name of the secondary window to the context string that identifies the target topic—all formatted as hidden text, of course, immediately after the double-underlined nonhidden text that appears to the user as the hot spot. To jump back from a secondary window to the main help window, you just code a hyperlink context string that ends with this hidden text:

```
>main
```

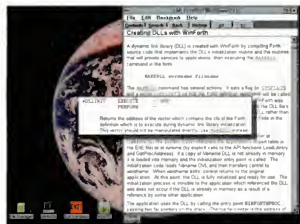


Figure 3: The Windows help file system provides an alternate way to display hyperlinked topics: pop-up windows. Here's an example.

The *window-name* is used to identify the secondary window type or *class* in the hidden text that is part of a hyperlink. It's possible to have up to five different secondary window types in addition to the help file viewer's main window. The *x,y*-coordinates give the initial position of the upper left corner of the secondary window on the screen. The position, *width*, and *height* are specified in help-system coordinates that always view the screen as 1,024-by-

Secondary windows have their limitations, too, although they are not nearly so dire as those of pop-up windows. Only one secondary window can be on the screen at a time, the secondary window can be closed unexpectedly by the user, it's difficult to control or close the secondary window once it is opened from within the help file itself, and topics that are displayed in the secondary window do not appear in the help viewer's History window.

BITMAPS Bitmaps are a wonderful way to make your help file more useful and attractive. You can capture entire screen dumps, or the contents of your program's window, to the system clipboard with the **PrtSc** or **Alt-PrtSc** key combinations, then use the resulting bitmaps to illustrate your help file and show the help file reader exactly what you are talking about. You can also design little icons and buttons with any bitmap editor and use them in your help file as decorations or as graphical hot spots. Take a look, for instance, at Figure 3, where a help file embeds one of the common dialogs as a graphic within a discussion of how to use that dialog.

In programmer lingo, bitmaps can be incorporated into your help source either by *value* or by *reference*. When you want to embed a bitmap by value, the easiest method is to copy it onto the system Clipboard one way or another (for example, by reading a bitmap file into Paintbrush, then choosing **Select-All** and **Edit-Copy**), followed by pasting it directly into your word processing document at the desired insertion point. (This assumes, of course, that your RTF-capable word processor supports such graphics shenanigans—

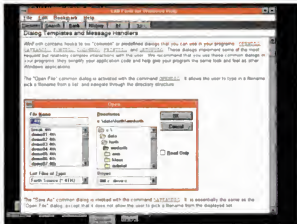


Figure 3: An example of a bitmap used in a Windows help file.

Bitmap-by-Reference Commands

COMMAND	DEFINITION
bmc	Character bitmap: The bitmap is treated as though it were a single character in the stream of text, and positioned on the same baseline. To save space, a single copy of the bitmap is stored in the help file separately from the text and shared by all bmc commands that reference that bitmap.
bml	Left-aligned bitmap: The bitmap is aligned at the left margin, and any text in the same paragraph is flowed around the right side of the bitmap. Storage is in the same fashion as bmc.
bmr	Right-aligned bitmap: The bitmap is aligned at the right margin, and any text in the same paragraph is flowed around the left side of the bitmap. Storage is in the same fashion as bmc.
bmcwd	Character bitmap: This works like bmc, except that a separate copy of the bitmap is stored together with the text each place it is referenced to improve performance.
bmlwd	Left-aligned bitmap: This works like bml, but storage is in the manner of bmcwd.
bmrwd	Right-aligned bitmap: This works like bmr, but storage is in the manner of bmcwd.

Figure 4: When you embed a bitmap into a help file by reference, you just insert one of these special commands into the help source that indicates the name of the file containing the bitmap, how the bitmap is to be aligned in the displayed text, and how it is to be stored.

Word for Windows, luckily, does.) This approach has the advantage of giving you a better idea of what the final compiled help file will look like, but it bloats the document file and slows the word processor horrendously.

When you embed a bitmap into the help file by reference, you just insert a special command into the help source that indicates the name of the file containing the bitmap, how the bitmap is to be aligned in the displayed text, and how it is to be stored. At help file compilation time, the help file compiler interprets this command, retrieves the bitmap from the separate file, and incorporates it into the forming help file.

The bitmap-by-reference commands take the following form:

```
(command filename.bmp)
```

where *command* is one of the commands listed in Figure 4. For example, to include the file **MYMENU.BMP** in your help file as a left-aligned bitmap, you would insert the following command in the help file source:

```
(bml mymenu.bmp)
```

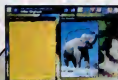
Note that the bitmap-by-reference commands are not formatted as hidden text. Bitmaps

can be turned into hyperlink hot spots, on the other hand, by the simple expedient of underlining the bitmap-by-reference command (double-underlining for a normal hyperlink, or single-underlining for a pop-up window), and then inserting the context string for the destination of the hyperlink as hidden text after the bitmap command.

The more you use bitmaps in your help files, the more you'll like them, and the more quickly you'll run up against the help compiler's rather severe memory limitations on bitmaps. The help compiler simply gives up when it encounters bitmaps that are greater than 64K when compressed, but the compression factor is difficult to predict in advance. There is also, in the DOS version of the help compiler, a remarkably low limit on the total kilobytes of bitmaps that can be processed in a single compilation; this limit seems to be about 320K on my own machine, even though the machine has huge amounts of expanded and extended memory available. Microsoft claims that the OS/2 version of the help compiler is less limited, but my own experiences with the OS/2 version have not been very favorable.

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PCs

MEMORY PARITY ERRORS IN WINDOWS

I read your discussion of memory parity errors in the December 8, 1992, issue, but I still have a question. I have been plagued by memory parity errors also, but only when running Windows 3.1. I haven't seen any DOS parity error messages, nor has my system ever rebooted by itself. Why am I only getting these errors in Windows?

Toivo S. Aijo
Long Beach, California

► PC MAGAZINE: The most likely culprit is still a bad chip. The problems probably don't show up when you're running DOS applications, because they aren't trying to use the part of memory where the bad component is located.

Typical Windows installations have at least 2MB of memory and, since increased amounts of memory can significantly improve Windows' performance, many have 4MB, 8MB, or more. With this much memory, the odds are that a bad chip will fall outside of the first megabyte.

Most DOS programs use only the first 640K of memory. Even if they use extended or expanded memory above the first megabyte of RAM, it's only to hold data.

On the other hand, Windows uses all your system's memory, including memory located above the 640K DOS limit. Unlike DOS applications that use this memory for data only, Windows uses it for program code as well. Since program instructions are executed from this location, Windows exercises the chips much harder than a typical DOS application would. And Windows often uses *all* of your memory (something DOS programs rarely do); it resorts to your system's swap file only after all available memory has been used. Thus, Windows is more likely to run into a faulty chip.

Our Advisors

Douglas Beling is a contributing editor and the author of many utilities, including MBOOT.COM and EMS40.SYS.

Frank J. Dorfner, Jr., is senior networking editor and the author of the PC Magazine Guide to Connectivity.

Alfred Poor is a contributing editor and the author of the Hewlett-Packard LaserJet Printer Handbook.

Jeff Promise is a contributing editor and the author of the PC Magazine Guide to DOS 5 Memory Management.

Sal Nicolardi is a contributing editor and the author of the forthcoming *Running FoxPro* books from Microsoft Press.

Nell J. Rubenking is technical editor and the author of two Turbo Pascal books and PC Magazine DOS Batch File Lab Notes.

Joe Salemi is a contributing editor and the author of the PC Magazine Guide to Client/Server Databases.

Luisa Simone is a contributing editor and the author of the book *Microsoft Publisher*.

Craig Stinson is a contributing editor and coauthor of *Running Windows 3.1* and *Running Microsoft Excel*.

M. David Stone is a contributing editor and coauthor of *Word for Windows Companion*, Second Edition.

Ethan Winer is a contributing editor and the author of PC Magazine BASIC Techniques and Utilities.

You might not think that a bad chip is the source of the problem, however, since the computer always checks its memory when you turn it on. The fact of the matter is that the Power On Self Test (POST) for microcomputers is notoriously superficial. It does little more than

count fingers and toes to make sure that all the parts are there, and does not check thoroughly that those parts are operating correctly.

The best solution is to get a diagnostic utility that exercises every portion of your computer's memory to make sure that it's functioning correctly. CheckIt, QAPlus and Sleuth are a few good examples.

Some users may be concerned that a subtle memory conflict, such as improperly configured upper memory blocks, could be causing a parity error. According to a source at Microsoft, there haven't been any reports of this, and it's far more likely that a bad chip is causing the problem.—*Alfred Poor*

Peripherals

THE THIN GRAY LINE

I have a new Sony monitor that usually provides an excellent image, except that sometimes there seems to be a thin, gray horizontal line running across the entire screen. What could be causing this? Do you think I should return the monitor and ask for a new one?

Bob Kramer
New York, New York

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► **PC MAGAZINE:** Many users prize Sony monitors and others that use the Trinitron display tube technology. On most systems, images are sharp and bright, and the cylindrical cross section of the screen makes the glass surface flat along the vertical dimension, reducing glare.

Some users believe that their monitors are defective, however. When running Windows—or some other application that fills the screen with a white background—they see a faint gray, horizontal line running from the left edge of the screen to the right, about one third of the way up. When a program is run that uses a black or dark background, however, the line seems to disappear. On the other hand, many users never even notice the line until someone points it out to them.

The line is not the result of a manufacturing defect. It's an artifact of the tube's design. A thin wire is used inside the tube to tension the shadow mask just inside the screen's front surface. This wire intercepts the stream of electrons headed from the tube's electron guns, blocking them from reaching the phosphors on the inside of the screen. In effect, it casts a shadow, just as when an object blocks the light from a light source.

So, there's nothing wrong with these monitors. If you're considering a monitor based on Trinitron technology, be sure to look at a sample while it's running the applications you intend to use, and at the same resolution. This will give you the opportunity to decide whether the shadow bothers you, before you buy.

—Alfred Poor

RETRIEVING LOST PRINTER LABELS

► **PC MAGAZINE:** You probably read the admonition in your printer manual about the types of labels you can use safely in your printer. But you had an important mailing to get out, you didn't have the right labels, and you figured it was worth the risk.

You fed ten labels into the printer, but only nine came out. Now what?

The fact is that labels rarely misfeed in printers, but when they do, it can be a nightmare. They jam the paper path,

putting your printer out of commission until you get them out.

Dot matrix printers with rolling platen are generally easy to fix, since the platen can often be removed quickly so you can get at the sticky culprit. Reaching the lost label in laser printers and fixed-platen printers can be a bit trickier, however, and may require some disassembly. (If you aren't comfortable handling small screws and putting puzzles back together without directions, it might be a good idea to get professional assistance for these printers.)

With either type of printer, the key is to release the label's hold on the printer's parts. Most label adhesives can be dissolved using a lightweight oil; a penetrating oil like WD-40 or plain salad oil should do the job. Small amounts of these oils aren't likely to harm your printer, and can soften the adhesive enough so you can remove the label.

When you've extracted the label, wipe up any excess oil you can reach. Be sure to run a few pages through your printer to make sure the blockage has been completely removed and that no blobs of oil remain to spoil a printed page.

—Alfred Poor

HOW TO CONTACT US

Do you have a hardware, software, or systems problem you can't solve? Do you have a tip you think other readers could use? Or maybe you'd like a better understanding of how something works. If so, we invite you to let us know about it. Our experts can give you practical solutions to your problems, provide techniques for using your software and hardware more productively, and help you grasp computer concepts and understand the latest technology.

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UNDERSTANDING MONITOR SPECIFICATIONS

❶ I want a new monitor to go with my Super VGA card, but I'm confused by the monitor specifications. The one I want lists a horizontal scan frequency of "27 to 57 kHz" and vertical frequencies of "31.5 to 90 Hz." Will I be able to run this at 800-by-600 resolution with a 72-Hz refresh rate?

Harry Goldman
Albany, New York

► **PC MAGAZINE:** When scan rates are listed as ranges, it can indeed be confusing. The key is to focus on the horizontal rates, and in this case, they can tell you that the monitor should work with your card.

With the emphasis these days on reducing monitor flicker, most users know that they want to use as fast a vertical refresh rate as possible. The vertical refresh rate is defined as the number of times per second that the image is painted on a screen. Lower refresh rates tend to produce a noticeable flicker in the image.

The VESA standard calls for 72-Hz

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Resolution and Scan Rates

Resolution	Scan Rates	
	Vertical (Hz)	Horizontal (KHz)
640-by-480	60	31.5
	70	35.5
	72	37.7
800-by-600	56	35.5
	60	37.9
	70	44.2
	72	48.4
1,024-by-768 (noninterlaced)	60	48.0
	70	56.0
	72	58.0
(interlaced)	87	35.5

Figure 1: As this chart shows, for a given vertical scan rate, the higher the resolution, the higher the horizontal scan rate must be (because there are more lines to paint on the screen in a given vertical scan period). And for a given resolution, the higher the vertical scan rate, the higher the horizontal scan rate must be (there is less time to paint the lines on a screen because the vertical scan-rate period is shorter).

refresh at 800-by-600 and 1,024-by-768 resolutions, noninterlaced. But a monitor that reportedly handles up to 90-Hz vertical refresh rates may not give the flicker-free image that you expect. To see the whole picture, you need to look at both the horizontal and vertical scan rates. The horizontal scan rate is defined as how many times per second the monitor's electron beam starts over at the left edge of the image.

The actual frequencies used may vary slightly from one card design to the next. Figure 1 lists the different scan rates required for some common resolutions.

To run a video card at 800-by-600 resolution, with a 72-Hz vertical scan rate to minimize flicker, the monitor would have to handle a 48.4-kHz horizontal rate. These values both fall within the ranges Mr. Goldman stipulates.

On the other hand, assume we have a monitor that specifies 60- to 90-Hz vertical refresh rates, but only 31.5- to 35.5-kHz horizontal scan rates. The vertical numbers look good enough to cover 1,024-by-768 noninterlaced, but when you look at the horizontal range, the monitor falls short. With a maximum of 35.5-kHz horizontal rate, the only way the monitor can handle a 1,024-by-768 signal is as an interlaced signal. Sure, it can refresh the screen up to 90 times per second, but because of the limitations of

the horizontal scan rate, it will only be able to do half the image at a time. This requires an interlaced image signal, which effectively reduces the refresh rate to 45 Hz or less and can lead to significant flicker problems. If you want to run this same monitor in 800-by-600 mode, the best you can expect is a vertical refresh rate of 56 Hz, which is also likely to produce noticeable flicker.

So make sure your monitor can handle the scan frequencies produced by your video adapter in the resolution modes you intend to use. The critical specification is the horizontal scan rate range. It often pays to spend a little more to get a higher vertical scan rate so you won't have to deal with

flicker problems.—*Alfred Poor*

Operating Environments

ELIMINATE BAD COMMANDS

❶ Perhaps you can explain the "Bad command or filename" message that frequently appears on my screen. The major applications I've installed are Windows 3.1, The Norton Utilities 6.01, The Norton Desktop for Windows, Stacker, and Central Point Backup. When I boot up, the message appears immediately after the line "The memory-resident portion of SMARTDrive is loaded"; then it appears again after Norton's "Finished updating IMAGE for drive C:" and again whenever I exit Windows.

Can you explain what's happening, and what I should do to correct it?

*Allan Rosenberg
Boynton Beach, Florida*

► **PC MAGAZINE:** When DOS processes a command line, whether it's one you typed at the prompt or a line in a batch file, it goes through several steps to interpret the command that starts the line. If DOS 5.0's DOSKEY utility is loaded, DOS first checks to see whether the command matches a DOSKEY macro name.

Next it compares the command against its list of internal commands. If the name doesn't match a DOSKEY macro or internal command, DOS starts looking for an external program. It looks in the current directory for a matching .COM, .EXE, or .BAT file, in that order. Next it searches the directories on the PATH, again seeking matching .COM, .EXE, and .BAT files. If this whole process turns up nothing that matches the command, DOS gives up and displays the message "Bad command or filename."

That's what's happening and what it means. As for what you should do to correct it, start by deleting the @ECHO OFF line in your AUTOEXEC.BAT. Reboot and watch carefully to see exactly what command immediately precedes the bad command message. If the messages fly past too quickly, insert the PAUSE command between every few lines of your AUTOEXEC and try again. In this way, you'll determine exactly which lines are causing the problem.

Now try those problem lines "by hand" at the DOS prompt to see what's wrong. Perhaps the command is misspelled in your AUTOEXEC.BAT, or perhaps the program's directory isn't on the PATH. Once you can correctly load the program from the DOS prompt, edit your AUTOEXEC file to incorporate the corrections and restore the @ECHO OFF line.—*Neil J. Rubenking*

MOVING THE WINDOWS SWAP FILE

❶ The permanent swap file created in Windows 3.1 is placed as an unmovable file anywhere on a hard disk, usually at the beginning of free file space. Subsequent file-writing operations embed this file and make housekeeping operations more difficult. Is there a way to force the file to the end of the disk?

*Manfred Lichtensteiger
Woburn, Massachusetts*

► **PC MAGAZINE:** A Windows 3.1 swap file must be physically continuous, so its location and maximum size will depend on how fragmented your disk is. The only way to force the swap file into a particular location on the disk is to make *no* other

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EATDISK.PAS

Complete Listing

```

PROGRAM EatDisk;
{First parameter is number of kilobytes to "eat",
second is directory in which to create EATDISK.$$$
e.g. EATDISK 4096 D:\ to eat 4M on drive D;}
VAR
  HpwMuch : LongInt;
  Code    : Integer;
  F       : File;
BEGIN
  IF ParamCount > 1 THEN
    BEGIN
      Val(ParamStr(1), HpwMuch, Code);
      IF (Code = 0) AND (HpwMuch > 0) THEN
        BEGIN
          Assign(F, ParamStr(2) + 'EATDISK.$$$');
          Rewrite(F, 1);
          Seek(F, (HpwMuch * 1024) - 2);
          BlockWrite(F, Code, 2);
          CloseWrite(F);
          Close(F);
        END;
      END;
    END;
  END.

```



Figure 2: This tiny program is one way to eat up disk space, forcing Windows to locate its permanent swap file at the end of the disk.

location possible. Start by getting rid of any existing permanent or temporary swap file. Bring up the Control Panel and open the 386 Enhanced icon. Press the Virtual Memory button, and press the Change button in the dialog that appears. Select None in the Type combo box. After you confirm that you want to make a change, you'll be prompted to restart Windows—don't do it! Instead, exit Windows entirely.

Now use *PC Magazine's* DEFRAGR (February 23, 1993) or a similar program to defragment the target disk, and restart Windows. Then just fill up the disk until only the amount of space you want for the swap file remains. There are a number of ways you can do this; one method is to create a document in your word processor and keep doubling its size using cut-and-paste. Or you can use the tiny Pascal program shown in Figure 2 to eat up disk space in increments of 1K. (You can download the source code and executable files from PC MagNet, archived as EATDISK.ZIP.) The program will compile under either the DOS or Windows versions of Borland's Pascal compiler. Invoke it by passing the number of kilobytes to grab and the directory in which to place its temporary file. If the parameters are valid, the program creates EATDISK.\$\$\$ in the specified directory with the specified size; if not, it does nothing.

Note that the size will round up to the cluster size of your hard disk, typically 2K. For example, to consume 4 megabytes on drive D:, use the command EATDISK 4096 D:\.

When the space remaining on the target drive has been reduced to the desired swap file size, bring up the Virtual Memory dialog from Control Panel's 386 Enhanced utility again. Press Change, then set the Drive combo box to the target drive and the Type combo box to Permanent. The Space Available and

Maximum Size lines should both display the desired swap file size. Enter this value on the New Size line and press OK. You'll get a warning that Windows won't use the specified size—ignore it. When you're prompted to restart Windows, select Continue instead. Delete EATDISK.\$\$\$ and then restart Windows.

If the Maximum Size line doesn't show the same value as the Space Available line, it's almost certainly because your disk has a bad sector in the area targeted for the swap file. Just about every disk has one or more bad sectors; it doesn't mean there's anything wrong with the disk. But since the permanent swap file must be physically continuous on-disk, it cannot contain any bad sectors. You'll simply have to accept another location for your swap file.

—Neil J. Rubenking

Word Processing

MERGING TEMPLATE FILES IN WORDPERFECT

TIP The Working Word columns in the February 11 and September 15, 1992, issues discuss WordPerfect macros that let you load files to use as templates without

risking overwriting the originals. Another alternative for loading the templates is for the macro to run a merge. To create the macro, start the Macro Define feature, then type Ctrl-F9, and pick Merge. Enter the drive, path, and filename for the template file in response to the prompt for the Primary file, and simply hit Enter to respond to the prompt for a Secondary file. The macro you wind up with will take the form

```

(Merge/Sort)MFilePathAndName(Enter)
(Enter)

```

When you run this, the macro will merge the file into the current document screen, so if you start in an unnamed document, you'll wind up with an unnamed document.

Mark W. Petersmeyer
Libby, Montana

►PC MAGAZINE: Choosing between this approach and the one discussed in the earlier columns is a classic case of "six of one, half a dozen of the other." Both approaches will work in either Version 5.0 or 5.1, and both provide essentially the same functionality for using template files. The advantage of this approach is that it is identical to the procedure you can use for a fill-in-the-blanks form to ask for input from the keyboard at merge time—using the Input field in Version 5.1 (entered with Shift-F9, I) or the ^C marker in Version 5.0 (entered with Shift-F9, ^C). This lets you use one approach for two similar procedures.

Note that whether you use the Merge command as shown here, or the Retrieve command as discussed in earlier columns, the macro will merge the template file into the currently open document, even if there is already data in the document.—M. David Stone

A WINWORD ROW- AND COLUMN-ADDING SHORTCUT

TIP When editing a Word for Windows 2.0 table, you can insert new columns or rows by placing the cursor in the appropriate row or column and clicking on the Table button in the Toolbar. WinWord will respond with a dialog box that lets



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you specify whether to enter a cell, row, or column.

But there's also an easier way. Say you want to add a new row. Select the row in the position where you want to insert the row. If you want the new row to be the second row, for example, select row two. Then click on the table button, and WinWord will insert the row without stopping to show you a dialog box. The same approach works for columns. Simply select a column in the position where you want a blank column and click on the Table button.

Juan Antonio Pena
Bowling Green, Kentucky

► **PC MAGAZINE:** Although this shortcut doesn't seem to be mentioned in the WinWord manuals, it's actually a straightforward extension of the underlying feature. After all, if you select only part of a row or column before giving an insert command, there's no way for WinWord to determine whether you plan to insert rows, columns, or cells, except by asking you to fill in the answer in a dialog box.

If you've highlighted one or more entire rows, in contrast, the only choice is to insert rows. Similarly, if you've highlighted one or more entire columns, the only choice is to insert columns. This technique works for inserting multiple rows or columns as well as for one at a time. Simply select the same number of rows or columns you want to insert.

Keep in mind that selecting an entire row is not the same as selecting all the cells in a given row. To select a row with the mouse, move the mouse cursor into the invisible selection bar to the left of the table. (You'll know you're there when you are clearly to the left of the left-most cell, and the mouse cursor shows as a right-pointing arrow.) Move the pointer alongside the row you want to select, and click the left button. If you want to select more than one row, hold down the button as you extend the selection.

Likewise for columns, move the cursor just above the top of a cell; the cursor changes to a downward pointing arrow, and if you click the left mouse button, you'll select the entire column. If you hold the mouse button down, you can move to the right or left to select additional columns.

Keyboard users can take advantage of a similar shortcut. To select one or more rows from the keyboard, move the cursor to highlight any cell in the first row you want to select, extend the selection to additional rows if you like, then choose Table | Select Row, then Table | Insert Rows. To insert one or more columns, move the cursor to any cell in the first column you want to select, extend the selection to additional columns if you like, then choose Table | Select Column, Table | Insert Column.—*M. David Stone*

Spreadsheets

A RETRIEVE COMMAND FOR EXCEL

► **TIP** I recently switched from Quattro Pro to Excel, and one thing I miss is Quattro Pro's File | Retrieve command. I would often use this command to replace one file with another. So, I decided to write an Auto_Open macro that would put this command on all of Excel's File menus. The macro is shown in Figure 3.

Cells A8:D8 (the range named Retrieve) define the menu command Retrieve, and cells B1:B5 add it to all menu bars except number 3, which is only visible when all files are closed and thus doesn't need a Retrieve command. The File_Retrieve section, B10:B14, carries

out the command's work. It first closes the current file. Then it presents the standard File | Open dialog box. If the user selects and opens a file, the macro skips to its RETURN statement at B6. If the user cancels out of the Open dialog box, the macro uses NEW(1) to open a fresh worksheet.

It is conceivable that at some point I may not wish these commands to appear. The result is the macro at B16 named Return_Menus, which restores all of Excel's default menu bars. To simplify changing things around, I set up the Return_Menus macro to be invoked by Ctrl-Z.

Gregg J. Hommel
Kitchener, Ontario, Canada

► **PC MAGAZINE:** In my opinion, the addition of a Retrieve command provides a real enhancement to Excel's user interface. We don't *always* work with two or more files at once, after all. Many, if not most, users typically work with only one file at a time. When they're through with that file, they want to get rid of it and load another. In Excel's native menu tree this entails two operations, a close and an open. Why not combine the two with a Retrieve command?

Mr. Hommel's macro has one flaw: It closes the current document before it presents the Open dialog box. If an errant mouse stroke puts you in the Retrieve command by accident, your Cancel click

RETRIEVE.XLM

Partial Listing

	A	B	C	D
1	Auto_Open	=ADD_COMMAND(1,"File",Retrieve,"Close")		
2		=ADD_COMMAND(2,"File",Retrieve,"Close")		
3		=ADD_COMMAND(4,"File",Retrieve,"Close")		
4		=ADD_COMMAND(5,"File",Retrieve,"Close")		
5		=ADD_COMMAND(6,"File",Retrieve,"Close")		
6		=RETURN()		
7				
8	&Retrieve...	retrieve.xlm!File_Retrieve		Close Active File and Open Another
9				
10	File_Retrieve	=CLOSE()		close the current file
11		=OPEN?		open file dialog box
12		=IF(B11=TRUE,GOTO(B14))		check for cancel
13		=NEW(1)		
14		=RETURN()		
15				
16	Return_Menus	=ADD_BAR(1)		restore
17		=ADD_BAR(2)		all menus
18		=ADD_BAR(4)		to defaults
19		=ADD_BAR(5)		
20		=ADD_BAR(6)		
21		=SHOW_BAR()		
22		=RETURN()		

Figure 3: This macro adds a Retrieve command to Excel's File menus.

RETRIEV2.XLM

Complete Listing

	A	B	C	D
1	Auto_Open	=ADD.COMMAND(1,"File",Retrieve,"Close")		
2		=ADD.COMMAND(2,"File",Retrieve,"Close")		
3		=ADD.COMMAND(4,"File",Retrieve,"Close")		
4		=ADD.COMMAND(5,"File",Retrieve,"Close")		
5		=ADD.COMMAND(6,"File",Retrieve,"Close")		
6		=RETURN()		
7				
8	&Retrieve...	retriev2.xlm!File_Retrieve		Close Active File and Open Another
9				
10	File_Retrieve	=ECHO(FALSE)		
11	Currentdoc	=GET.DOCUMENT(1)		
12		=OPEN(?)		
13		=IF(B12=TRUE)		
14		= ACTIVATE(Currentdoc)		
15		= CLOSE()		
16		=END.IF()		
17		=RETURN()		
18				
19	Auto_Close	=DELETE.COMMAND(1,"File",Retrieve...)		Remove all Retrieve commands
20		=DELETE.COMMAND(2,"File",Retrieve...)		
21		=DELETE.COMMAND(4,"File",Retrieve...)		
22		=DELETE.COMMAND(5,"File",Retrieve...)		
23		=DELETE.COMMAND(6,"File",Retrieve...)		
24		=RETURN()		

Figure 4: This modification of RETRIEVE.XLM makes sure a new file is opened before closing the old one.

will get you a new blank worksheet, but it won't bring back the one you were working with. Simply reversing the order of the CLOSE() and OPEN(?) commands in the macro's File_Retrieve section won't help, because the CLOSE() will then act upon the newly retrieved worksheet, rather than the one with which you're presumably finished.

Figure 4 shows how you can get around this problem with GET.DOCUMENT(1). This instruction returns the name of the current document. Then, assuming the user has actually opened a new file, the IF/END.IF block in B13:B16 activates and closes the document whose name is in B11. To reduce screen noise while all this activating and closing is going on, I've also included an ECHO(FALSE) statement in B10.

The cleanup macro listed in B16:B22 of Figure 3 could be made more versatile. You won't want the ADD.BAR statements in B16:B20 to restore Excel's factory-default menu bars if you use other macros or add-ins that modify Excel's standard menus. Rather than resetting the original menu bars, why not just delete the Retrieve commands? Figure 4 shows how to do that. In Figure 4, the cleanup routine has also been assigned the name Auto_Close so that it will run automatically whenever the macro sheet

on which it is stored is closed.

When recreating Mr. Hommel's macros (with or without my modifications) on your system, be sure to assign the name Retrieve to the range A8:D8. Then assign the other labels in column A to the adjacent cells in column B. For maximum convenience, you might want to save the macro in an add-in macro sheet (an .XLA) file and put it in your XLSTART directory. That way you won't ever have to look at it, and the File Retrieve command will become a permanent part of your Excel interface.

You can download both macros from the Utilities/Tips Forum on PC MagNet, archived as RETRIE.ZIP.

—Craig Stinson

▶ Databases

DEBUGGING STRATEGIES FOR FOXPRO

TIP I read "Debugging Using ON KEY LABEL" in the April 28, 1992, Databases column with interest because I use a similar method to debug my FoxPro applications.

The tip suggested using the following statement:

ON KEY LABEL F10 SUSPEND

to bind the SUSPEND command to the F10 key for use during debugging.

I take it a step further, however. Since FoxPro can read the DOS environment, I set up an environment variable that specifies whether or not to run the program in debugging mode. If the environment variable exists and has the right contents, I run a routine that sets things up for debugging. Since it's not likely that the target machine will have the same environment variable set up the same way, I usually leave the debugging code alone and let the environment specify whether or not to run the application in debug mode.

To do this, I place the following line in my AUTOEXEC.BAT:

SET MYDEBUG=xyz

Then I place the following code early in my main program:

```
IF GETENV('MYDEBUG') = "xyz"
  DO DEBUGON
ELSE
  DO DEBUGOFF
ENDIF
```

The DEBUGON procedure activates the Debug and Trace windows and moves them below the application's screen area. This assumes that the application runs in normal 80-character by 25-line mode and that 50-line (VGA) mode is available. It also assigns SUSPEND to the F9 key, and sets up Ctrl-PgUp and Ctrl-PgDn to call two routines, which I've named SLOWDOWN and SPEEDUP (shown in Figure 5).

The SLOWDOWN and SPEEDUP routines let me slow down or speed up my application as it's running in the Trace window. Slowing down a RESUME'd application makes it easier to see what's happening. By assigning these two routines to the Ctrl-PgUp and Ctrl-PgDn keys, I can adjust the speed of my Trace window interactively.

I use the F9 key to invoke the SUSPEND command instead of using F10 for two reasons. First, it's located at the left edge of the block of four keys on an enhanced keyboard (F9, F10, F11, F12),

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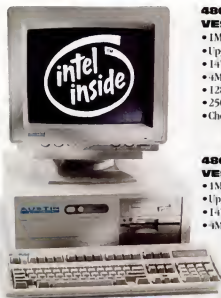
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Foxpro Debugging Procedures

```

PROCEDURE speedup
PARAMETERS increment
IF (_THROTTLE + increment) >= 8    && Can't be less than zero
    _THROTTLE = _THROTTLE + increment
ENDIF
RETURN

PROCEDURE slowdown
PARAMETERS increment
IF (_THROTTLE + increment) < 5.6    && Can't be more than 5.6
    _THROTTLE = _THROTTLE + increment
RETURN

PROCEDURE debugon
SET DISPLAY TO VGA50
ON KEY LABEL F9 SUSPEND
ON KEY LABEL Ctrl-PgUp DO SLOWDOWN WITH 0.1
ON KEY LABEL Ctrl-PgDn DO SPEEDUP WITH -0.1
ACTIVATE WINDOW Debug
ACTIVATE WINDOW Trace
ZOOM WINDOW Debug NORM FROM 26, 01 SIZE 66, 78
ZOOM WINDOW Trace NORM FROM 33, 01 SIZE 16, 78
RETURN

PROCEDURE debugoff
SET DISPLAY TO VGA25
IF VISIBLE('Debug')
    DEACTIVATE WINDOW Debug

```

```

ENDIF
IF VISIBLE('Trace')
    DEACTIVATE WINDOW Trace
ENDIF
STORE 0 TO _THROTTLE
ON KEY LABEL Ctrl-PgUp *
ON KEY LABEL Ctrl-PgDn *
ON KEY LABEL F9 *
RETURN

REM ALFATEST.BAT - Turn off debugging and run the application
REM
IF %1. == . goto :nomame
SET OLDDEBUG=MYDEBUG
SET MYDEBUG=
REM Use FOXPRO or FOXPROL if you don't own the Distribution Kit,
REM or if you have built your application as an .EXE,
REM remove the word FORK
FOR %1
SET MYDEBUG=OLDDEBUG
SET OLDDEBUG=
GOTO :done
:nomame
ECHO You didn't supply an application name to test!
:done

```



Figure 5: FoxPro routines and a batch file that enable or disable debugging under program control.

which makes it much easier to find. Second, the F10 key is often used to activate the menu bar.

The debug routines are defined here as procedures, but I actually store them in a subdirectory called \DEVELOP \COMMON as separate program files and reference them whenever I need a debug routine in an application. This will work if you are using the Project Manager in FoxPro 2.0.

The DEBUGOFF routine, of course, reverses all of the efforts made in DEBUGON.

Often while debugging an application on my development system, I'll need to run the application normally to see how it operates under real-life conditions. For this reason I have a batch file called ALFATEST, to which I pass the application name as a parameter. Its purpose is to save the state of the existing MYDEBUG environment variable and then nullify MYDEBUG so that I can run the application normally. When the application finishes, the batch file restores MYDEBUG to whatever it was set to previously.

Richard A. Hurd
Nazareth, Pennsylvania

► **PC MAGAZINE:** Everyone has a favorite approach to debugging. Using a DOS environment variable in this manner makes it easy to externalize the decision to enable or disable debugging logic embedded in your application. During the applica-

tion development process, this can be handy. However, once the application is stable and complete, you should remove the routines before producing the final shipping application. In general, if a debugging routine can somehow give the user access to things he or she shouldn't have access to, pull it out of a shipping application. No matter how well hidden, trap doors are an invitation to Murphy's Law. Exceptions to this rule are routines specifically designed for remote technical support, such as a procedure that provides status information without giving the user access to the command window.

Mr. Hurd uses several FoxPro features to make his environment more programmer-friendly. For example, there's the _THROTTLE system variable (see Figure 5). Normally, when the Trace window is open and you choose Resume, your application will execute at high speed until it reaches the next breakpoint. You can see FoxPro highlight each line as it executes (similar to the Animate capability in other debuggers), although it can be very difficult to keep up with FoxPro as it Traces through your program at full speed. That's where _THROTTLE comes in.

The _THROTTLE system variable stores a user-defined delay in seconds that occurs between every traced command. By setting _THROTTLE, you can slow down the Trace window to a speed that you're comfortable with. The tech-

nique presented here allows you to do this in small increments by hitting Ctrl-PgUp or Ctrl-PgDn.

New to FoxPro 2.0 is the ability to explicitly activate and deactivate the Trace and Debug windows under program control. Just use the window names Trace or Debug, as shown in the DEBUGON and DEBUGOFF procedures. You can also activate or deactivate the View window this way.

Mr. Hurd uses the SET DISPLAY and ZOOM WINDOW commands in to switch the display into 50-column mode and to move the Trace and Debug windows below line 25. This lets you view your application during debugging, unobstructed by the Trace and Debug windows.

Although a 50-line by 80-column display is handy for debugging, 50-lines by 120-columns is even better. If you have a multiscanning monitor and a VGA card, I highly recommend that you investigate Personics' Ultravision, a software utility that can provide you with enhanced display capabilities depending on your video card and monitor type. On my system I use Ultravision in combination with a NEC MultiSync 4D monitor and an old Video-7 VRAM VGA card to regularly run FoxPro in 120-by-50 mode. Since FoxPro automatically makes use of all your screen real estate, this setup provides lots of room for an 80-by-25 application as well as for the Debug, Trace,

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Command, and View windows. Ultra-vision also provides some great looking replacement screen fonts. Personics can be reached in Maynard, Massachusetts, at 800-445-3311 or 508-658-0040. The procedures discussed in this article can be downloaded from PC MagNet. Look for the file FPDBUG.PRg in the Utilities/Tips Forum.—*Sal Ricciardi*

Graphics

UNMASKING ILLUSTRATOR'S MASKS

❏ I meet with only limited success when I try to use Adobe Illustrator's masking function. What's the trick to getting consistent results when I create a masked object?

Christina Howe

Bowling Green, Kentucky

▶ **PC MAGAZINE:** You don't need a trick to make Illustrator's masking functions work properly. But to ensure that you meet all the conditions required for successful masking (and believe me, there are quite a few), you do need to understand exactly how Illustrator creates a mask.

Many vector-based drawing programs (those that, like Illustrator, rely on formulas for generating their lines and shapes rather than simply placing pixels on a page) offer masking functions. Vector masks are also known as clipping paths, because you use an outline (path)

to crop (clip) other objects. Take a look at Figure 6. The drawing on the right contains many objects that are neatly trimmed by the outline of the triangle. Notice that the circle (which is selected) actually extends past the boundary of the triangle—but only the portion within the triangle is displayed or printed, because the triangular mask hides the remainder of the circle.

Masks are useful because they allow you to create a common boundary for multiple elements. In Figure 6, the same mask trims the circular sun, all of the rays, a red rectangle, and the blue free-form cloud. You can use masks—which can be regular geometric shapes or totally free-form—to crop vector objects created within Illustrator or bitmapped pictures imported from external sources.

At first glance, masking in Illustrator seems pretty simple. You select the object to use as a clipping path, open the Paint Style dialog box (either by double-clicking the object with the right mouse button or using the Paint menu), give the object a fill of None, assign whatever line style you think appropriate, and turn on masking by clicking the Mask option box—but the mask won't work unless you've properly prepared your drawing.

The following checklist should help you examine your drawing and determine why a mask isn't working.

- The mask outline must be a true path. If you created the mask using one of Illustrator's geometric primitives (a rectangle or an oval, for instance), you must use the Ungroup command to convert the object into a path composed of free-form lines and curves.

- A mask may not contain a center anchor point. Even if you have ungrouped and edited a rectangle or an oval, you must delete the center point manually. Figure 6 shows a triangle, which I created from a rectangle. As you can see, even though I ungrouped the rectangle and edited the object (by removing one of the sides to form a triangle), a center point remains. The center point, which appears as a small x, is still part of the object. To remove it I switched into wireframe (Art-

work Only) mode, the only mode in which you can see center anchor points. Then I used the Direct-selection tool (the hollow arrow) to highlight the anchor point and delete it.

- A mask will only work if the path is closed, meaning that the starting and ending points of the path have been joined together. If you create the mask outline using either the freehand or pen tools, double check to be sure that the object is closed. If the path is open, select both the starting and ending points, then use the Average and Join commands on the Arrange menu to create coincident points and to connect them.

- A mask can't be a grouped object. If you need to use multiple outlines for your mask, combine them with the Make Compound command (on the Paint menu). Creating a compound path is an especially important technique if you want to use multiple letters as a mask. Remember that a mask must be a path, not an object, so first you'll have to convert the text to a free-form shape using the Create Outlines command from the Type menu. Next, select all of the letters you want and turn them into a compound path.

- The mask outline must reside on the backmost layer of your drawing. Unfortunately, Illustrator offers minimal layering functions, so it's often difficult to know if you've truly sent the mask outline to the back of the stack. In order to ensure that it is behind all other objects in your drawing, first select the mask and use the Edit menu to cut it from the drawing, then use the Paste In Back command to position it on the bottom of the stacking order.

- By default, a mask outline will crop everything on the drawing page—including elements that you may not want masked. To apply the masking effect to selected objects, group them together with the mask. This releases all other objects in your drawing from the masking effect.

This checklist may seem intimidating at first, but if you can master the basic concepts outlined here—paths, compound paths, grouped objects, and stacking order—you'll be able to create masking effects consistently within Adobe Illustrator.—*Luisa Simone*

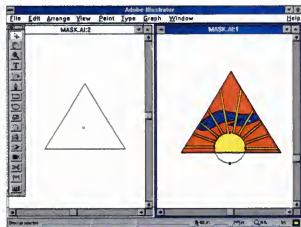


Figure 6: The vector outline (shown on the left) can be used as a mask. Notice how all the objects in the right window are trimmed to fit into the triangle shape.

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Networking

QUICKER NETWORK PRINTING

Q **TIP** Your November 24, 1992, column carried a tale of woe from a NetWare user who sent large print jobs to a LAN-based laser printer. Large jobs print very slowly on a network because the server collects the entire print job from the application before sending the first page to the printer. But I've found a trick that speeds things up: Just print the document a few pages at a time.

Our office regularly prints manuals of 300 or more pages from WordPerfect to a PostScript printer. If we print the entire manual at once, it can be 20 minutes before the first page comes out of the printer. The response is much quicker if we send only 30 to 50 pages at a time. Since the LAN considers each set of pages to be a separate print job, it prints the first set while spooling the second. This cuts our total print time in half or better, and provides the opportunity for proofreading the first pages of the document while the later pages are being spooled and printed. If we find an error that affects page breaks and numbering, we can cancel printing of the remaining pages and save paper.

This method also gives users with short 2- or 3-page documents a chance to have their jobs printed from the queue in between sections of the behemoth. It works well with Windows software such as PageMaker or Word for Windows.

You'll probably want to have your NetWare CAPTURE command include a Banner page with the name of the user, so that—in the pile of papers at the printer—you can easily tell where print jobs start and stop.

*Tony Krebs
Seattle, Washington*

►PC MAGAZINE: This is the kind of simple solution that makes you say, "Now why didn't I think of that?" Just don't forget that you'll also want to insert NA (No Autoendcap) into the client PC's CAPTURE command, so that the print server doesn't wait for the application to terminate before releasing the job.

—Frank J. Derfler, Jr.

MICROWAVE INTERFERENCE

Q Every day at 5:00 P.M. our 10BaseT network slows to a crawl, and a network analyzer shows a slew of retry messages and Ethernet frame fragments. Our company is located directly above a bank, and we've discovered that the vault alarm—a microwave detection system—is turned on at exactly 5:00 P.M. Our networking equipment is of very good quality, but it seems that the microwave signals are swamping the Ethernet signals. The problem isn't isolated to one or two nodes; it starts as soon as the wires from any two nodes are connected to the wiring hub. Do you think there is anything we can do about this?

*Sam Raney
Atlanta, Georgia*

►PC MAGAZINE: Here's something that might solve your problem. In Europe, particularly in Germany, vendors install 10BaseT using a 100-ohm shielded twisted-pair cable. This cable is different from the shielded twisted-pair cable used in Token-Ring networks, which has an impedance of 150 ohms and a much larger outside diameter. The 100-ohm shielded twisted-pair cable isn't much larger than the standard 100-ohm unshielded twisted-pair used for 10BaseT, but it has one layer of shielding around the entire cable. This shielding should easily block the microwave radiation from the bank's alarm system.

The only installation problem you'll face is how to properly ground the shield on the cable. If it isn't grounded at one end, typically the end at the wiring closet or hub, then the shield becomes an antenna and your problems will quickly multiply.

Mod-Tap (508-772-4884) sells the 100-ohm shielded cable and also markets a patch panel that can grasp the cable shield and ground it. You can terminate all of the 100-ohm shielded twisted-pair cables in the patch panel and retain the wiring hub and LAN adapters you've already installed. You'll need a good ground connection for the patch panel. The 100-ohm shielded twisted-pair cable offers more protection from interference than unshielded twisted-pair, while maintaining compatibility with 10BaseT

wiring hubs and avoiding the conduit-crowding problems that are associated with Token-Ring shielded twisted-pair wire.—Frank J. Derfler, Jr.

Languages

READING AND SETTING FILE ATTRIBUTES IN BASIC

Q We would like to know how to locate a file and modify its attributes from programs written in QuickBASIC. We have no problem creating files, but cannot find a way to set their attributes using BASIC commands.

*Daniel and Derek Soder
Sulphur Springs, Texas*

►PC MAGAZINE: Locating files and changing their attributes are two different things. QuickBASIC offers no direct way to read names of files from a directory, although the newer BASIC PDS and Visual Basic for DOS versions do. Reading filenames in a QuickBASIC program requires the CALL INTERRUPT command; with all versions of BASIC, CALL INTERRUPT is needed to read and set file attributes, because there are no built-in commands that do this.

The QBIDOS.BAS file that is shown in Figure 7 includes three functions that QuickBASIC programmers will find useful. QBDIR\$ is modeled after the DIR\$ command available in BASIC PDS and Visual Basic. GetAttr and SetAttr read and assign new file attributes, respectively, and they will be useful to all BASIC programmers. To use these functions, you should remove the demonstration portion of the program, as indicated by the comments included in the file. Then load the QBIDOS.BAS file as a module in the BASIC editor using the File...Load pull-down menu command. If you are using BASIC PDS or VB/DOS, you will not need the QBDIR\$ function. To delete it, just press the F2 key to show all the functions in the module, and then highlight QBDIR\$ and select the Delete option.

When QBDIR\$ is invoked with a file specification such as "*.DOC", it returns

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QBOS.BAS

Complete Listing

```
***** QBOS.BAS - reads file names from disk

'Copyright (c) 1993 Ethan Winer

DEFINT A-Z
DECLARE FUNCTION GetAttr% (FileName%)
DECLARE FUNCTION SetAttr% (FileName%, Attribute)
DECLARE FUNCTION QBDIR$ (FileSpec%)
DECLARE SUB Interrupt (IntNum, InRegs AS ANY, OutRegs AS ANY)

'----- Define the TYPE required by CALL INTERRUPT
TYPE RegType
  AX AS INTEGER
  BX AS INTEGER
  CX AS INTEGER
  DX AS INTEGER
  BP AS INTEGER
  SI AS INTEGER
  DI AS INTEGER
  Flags AS INTEGER
END TYPE

DIM SHARED DTA AS STRING * 44 'this is DOS' work area
DIM SHARED Regs AS RegType 'used by CALL Interrupt
DIM SHARED LocalSpec AS STRING * 80 'using a fixed-length string
                                ' supports both QB and DOS

'***** Beginning of demonstration portion, remove the following code
' when adding this module to another program.

CLS
Path$ = "C:\QBAS\ " 'use "" for the current directory
Spec$ = Path$ + "... 'find all matching files

DO
  This$ = QBDIR$(Spec$) 'read the name of first one
  IF This$ = "" THEN EXIT DO 'none found, all done
  PRINT This$; 'print the name

  Attr = GetAttr$(Path$ + This$) 'read its attributes
  IF Attr AND 1 THEN PRINT SPC(1); "Read-only";
  IF Attr AND 2 THEN PRINT SPC(1); "Hidden";
  IF Attr AND 4 THEN PRINT SPC(1); "System";
  IF Attr AND 32 THEN PRINT SPC(1); "Archive";

  PRINT
  Spec$ = "" 'kick out a new line
  Spec$ = " " 'clear Spec$ to find the next

LOOP

'***** END OF DEMO

FUNCTION GetAttr% (FileName%) STATIC
  LocalSpec$ = FileName$ + CHR$(0) 'add a CHR$(0) for DOS
  Regs.AX = &H4300 'get attribute service

  Regs.DX = VARPTR(LocalSpec$) 'show DOS where the local copy is
  CALL Interrupt(&H21, Regs, Regs) 'read the attributes

  GetAttr% = Regs.CX AND &HFF 'assign the output
  IF Regs.Flags AND 1 THEN 'oops, there was an error
    GetAttr% = -1 'return -1 as a flag
  END IF

END FUNCTION

FUNCTION QBDIR$ (Spec%) STATIC 'reports if a file exists
  LocalSpec$ = Spec$ + CHR$(0) 'add a CHR$(0) for DOS

  Regs.AX = &H1A00 'assign DTA service
  Regs.DX = VARPTR(DTA) 'show DOS where to place it
  CALL Interrupt(&H21, Regs, Regs)

  IF LEN(Spec%) THEN 'find first matching file
    Regs.AX = &H4E00
  ELSE 'find subsequent file names
    Regs.AX = &H4F00
  END IF

  Regs.CX = 39 'any file attribute okay
  Regs.DX = VARPTR(LocalSpec$) 'show DOS where the local copy is
  CALL Interrupt(&H21, Regs, Regs) 'see if there's a match

  QBDIR$ = "" 'assume no matching file is present
  IF (Regs.Flags AND 1) = 0 THEN 'if the Carry flag is clear, e
    FileName$ = MID$(DTA, 31, 13) 'file was found and its name
    Zero = INSTR(FileName$, CHR$(0)) 'is in the DTA with a trailing
    QBDIR$ = LEFT$(FileName$, Zero - 1) + CHR$(0)
  byte, strip the zero
  END IF

END FUNCTION

FUNCTION SetAttr% (FileName%, Attribute) STATIC
  LocalSpec$ = FileName$ + CHR$(0) 'add a CHR$(0) for DOS
  Regs.AX = &H4301 'set attribute service
  Regs.CX = Attribute
  Regs.DX = VARPTR(LocalSpec$) 'show DOS where the local copy is
  CALL Interrupt(&H21, Regs, Regs) 'assign the new attributes

  SetAttr% = 0
  IF Regs.Flags AND 1 THEN 'oops, there was an error
    SetAttr% = -1 'return -1 as a flag
  END IF

END FUNCTION
```



Figure 7: This file contains a demonstration and three functions that let you read filenames, as well as read and set their file attributes.

the first filename that matches this specification. To find subsequent matching files, invoke QBDIR\$ repeatedly, using a null string (""). QBDIR\$ returns a null string to indicate that no more matching files were found. Notice that QBDIR\$ accepts an optional drive letter and path for the search specification, but returns only filenames. Callers must merge the path with the filenames returned by QBDIR\$ before the file can be accessed. This is shown in the code's demonstration portion where each file's attributes are read.

The GetAttr function accepts a filename, and returns the file's attributes bit-coded as an integer value. BASIC'S AND operator is used to isolate each attribute bit, as shown in the demonstration. SetAttr is also designed as a function; it returns 0 if the file's attributes were modified successfully, or -1 if there was an error such as "File not found." In most cases you will use SetAttr to set or clear only one of a file's several attributes. Therefore you will need to invoke GetAttr to read the current attributes, and then use OR to set the desired new attributes using the same values (1, 2, 4, or 32) shown in the GetAttr demonstration. For example, to set the Read-only attribute for a file named ACCOUNTS.DAT, you would do this:

```
Attr% = GetAttr% ("ACCOUNTS.DAT")
Attr% = Attr% OR 1 'set Read-only bit
ErrCode = SetAttr% ('ACCOUNTS.DAT', Attr%)
IF ErrCode THEN
  PRINT "An error occurred."
END IF
```

To clear an existing attribute, you must follow a slightly more complicated procedure:

```
Attr% = GetAttr% ("ACCOUNTS.DAT")
Attr% = Attr% AND NOT 1
'clear Read-only attribute
ErrCode = SetAttr% ("ACCOUNTS.DAT", Attr%)
IF ErrCode THEN
  PRINT "An error occurred."
END IF
```

In this case you have to clear the individual bit that corresponds to a single attribute. BASIC'S AND and NOT operators solve this handily.

QBOS is available for downloading from the Programming Forum on PC MagNet.—Ethan Winer □

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- ✓ Full-Function, Standard Key-Spaced, 82-Key Sculptured Keyboard
- ✓ MS-DOS® 5.0 Operating System
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TOSHIBA T4500/ T4500C 486SX 20MHz

- ✓ 486SX/20 Processor
- ✓ MaxTime™ Power Management System 3.3 Volt Technology for Extended Battery Life
- ✓ 4 MB RAM, Exp. to 20 MB
- ✓ 8KB Cache
- ✓ 640 x 480 Display
- ✓ Simultaneous Display on External Monitor
- ✓ BallPoint™ Mouse with QuickPort™
- ✓ 16mm "Hot Plug" PCMCIA Slot

✓ Windows 3.1, DOS 5.0 and UltraFont Software

✓ 1 Parallel, 1 Serial, 1PS/2 Mouse and 1 PS/2 Keyboard Ports

✓ 1 150-Pin Bus Connector

✓ Monochrome 9.5" Diagonal, 64 Gray Scales, Color: 8.5" Diagonal, TFT-LCD Active Matrix 256 Color Display

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120 MB 256 Act. Matrix **\$3659.32** CDW 25551

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- ✓ Port For External Super VGA Monitor
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- ✓ Power On Password Protection
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- ✓ 4 MB RAM Expandable to 12 MB
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120 MB TOSHIBA BUNDLE..... **\$1453.44** CDW 27028

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EXTRAORDINARY QUALITY

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Comparison based on sequential read tests performed on a 16-bit controller and the new VESA Local Bus™ compatible IDE 32-bit controller.



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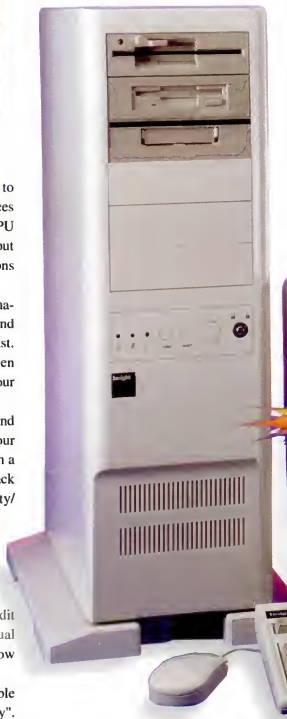
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Standard QIC attaches to existing floppy controller.
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Bare Drive Kit	\$299	Bare Drive Kit	\$329
16 Bit Kit	\$279	16 Bit Kit	\$349

210MB	IDE	340MB	IDE
Western Digital WD2310A, 12ms 3.5" 1" H		Western Digital WD2340A, 12ms 3.5" 1" H	
Bare Drive Kit	\$279	Bare Drive Kit	\$449
16 Bit Kit	\$299	16 Bit Kit	\$469



"They know more about hard disks than any other salespeople I spoke with."

- PC Magazine



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120MB	IDE
Talon TA3020A, 16ms 3.5" 1" H	
Bare Drive Kit	\$199
8 Bit Kit	\$239
16 Bit Kit	\$219
250MB	IDE
Talon TA3122A, 11ms 3.5" 1" H	
Bare Drive Kit	\$299
8 Bit Kit	\$339
16 Bit Kit	\$319

FUJITSU

420MB	IDE/SCSI	1080MB	SCSI
Fujitsu FJ2623A/S, 12ms 3.5" HH		Fujitsu FJ2266S, 14.5ms 5.25" FH	
Bare Drive Kit	\$779	Bare Drive Kit	\$1,299
16 Bit Kit (IDE)	\$799	16 Bit Kit	\$1,449
16 Bit Kit (SCSI)	\$929		
510/520MB	IDE/SCSI		
Fujitsu FJ2624A/S, 12ms 3.5" HH			
Bare Drive Kit	\$789		
16 Bit Kit (IDE)	\$809		
16 Bit Kit (SCSI)	\$939		

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Easy Install.**

BARE DRIVE KITS INCLUDE:

- Complete Mounting Kit (3.5" kits include 5.25" bezel)
- All Mounting Hardware (inc. screws)
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- Step-by-Step Installation Instructions

FOR 8 BIT (PCXT) KITS ADD:

- Controller (when applicable)
- Cable

FOR 16 BIT (286/386/486) KITS ADD:

- 1" to 1" Interleave Hard/Floppy Controller or Appropriate Interface
- Cable

CONNER

170MB	IDE
Conner CP30174A, 17ms 3.5" 1" H	
Bare Drive Kit	\$259
16 Bit Kit	\$279
250MB	IDE
Conner CP30254, 12ms 3.5" 1" H	
Bare Drive Kit	\$389
8 Bit	\$429
16 Bit Kit	\$409

Seagate

42MB	IDE	452MB	IDE
Seagate ST351A, 28ms 3.5" 1" H		Seagate ST3550A, 12ms 3.5" 1" H	
Bare Drive Kit	\$129	Bare Drive Kit	\$399
8 Bit Kit	\$169	16 Bit Kit	\$619
16 Bit Kit	\$149		

1000MB	SCSI
Seagate ST41200N, 12.9ms 5.25" FH	
Bare Drive Kit	\$1,049
16 Bit Kit	\$1,199

MICROPOLIS

660MB	SCSI	1050MB	IDE/SCSI
Micropolis MC1624, 15ms 5.25" HH		Micropolis MC2112A/S, 10ms 3.5" HH	
Bare Drive Kit	\$1,259	Bare Drive Kit	\$1,299
16 Bit Kit	\$1,409	16 Bit Kit (IDE)	\$1,319
		16 Bit Kit (SCSI)	\$1,449

Maxtor

130MB	IDE	240MB	IDE
Maxtor MX7120A, 15ms 3.5" 1" H		Maxtor MX7245A, 15ms 3.5" 1" H	
Bare Drive Kit	\$239	Bare Drive Kit	\$329
16 Bit Kit	\$259	16 Bit Kit	\$349

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M2511A.....



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Internal, 380ms access time, 32K buffer, 150KB transfer rate, adapter, headphones and software. Photo CD compatible. **\$269**

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New 1992 Toolworks Multimedia Encyclopedia

21 volume set. 33,000 articles w/3,000 pictures, 250 maps, 35 min. of video, 35 min. of sound and 55 video sequences.

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Standard OIC 80 attaches to existing floppy controller or dedicated unit. w/ data compr. 2-3MB/min.

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WangDAT is the premier name in Digital Audio Tape backup systems. These compact units offer the speed and reliability necessary for high capacity tape storage for DOS, Novell and UNIX-based systems. Now Super Direct™ Priced!

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4GB 3200 Internal 16 Bit Kit.....\$1,299

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The Mouse Alternative.

- Includes serial interface cable
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- PS/2 adapter
- 3.5" DOS driver diskette (5.25" available)
- Quick-release Velcro® attachment
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- 80MB hard drive
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- MS-DOS, Windows 3.1, MS-Works, Prodigy, Mouse

Internal Fax/Modem \$299.99

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T1850

- 4MB RAM, expandable to 12MB
- MaxTime Power system

Processor	DOS	Windows
386SX/25, 80MB	\$1489	\$1569
386SX/25, 80MB Color	\$2099	\$2169
386SX/25, 120MB Color	\$2269	\$2349

Lease for \$54.65/mo.

\$1489



COMPAQ

Conturo 3/25

- 25 MHz 386SL
- 4MB expandable to 12MB
- 64KB cache
- MS-DOS, Windows, Trackball

Display	Hard drive	Price
Mono	120MB	\$1599
Color	84MB	\$1999
Color	120MB	\$2149

Lease for \$58.68/mo.

\$1599



PowerExec EL Model 3

- 386SL/25 processor
- 4MB RAM, expandable to 8MB
- PCMCIA slot
- Trackball optional
- Requires hard drive

Model	3 w/Hard Drive	Price
80MB		\$1629
120MB		\$1799
200MB		\$1999
Model 123/W w/ 120MB Windows 3.1, Trackball		\$1829

Lease for \$59.78/mo.

\$1629



TravelMate 4000

- 486 processor
- 10" display, 64 gray scale
- MS-DOS, Windows 3.1

Processor	RAM	Hard Drive	Price
486SL/25	2MB	60MB	\$1639
486SL/25	4MB	80MB	\$1719
486SX/25	4MB	120MB	\$1899
486DX/25	4MB	120MB	\$2399
486DX/25	4MB	200MB	\$2579
486DX/50	8MB	200MB	\$2999

Lease for \$60.15/mo.

\$1639



PowerExec 3/25SL

- 386SL/25 processor
- 4MB RAM, expandable to 20MB
- 64KB cache, 2 PCMCIA slots
- MS-DOS

Screen	Hard drive	Model	Price
Mono	80MB	3	\$2009
Mono	120MB	123/W	\$2049
Active Color	200MB	203/W	\$3499

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\$2009

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- MS-Productivity, Quicken

Processor	Drive	Price
486SX/33	130MB	\$1089
486SX/33	213MB	\$1169
486DX/33	130MB	\$1259
486DX/33	245MB	\$1369
486DX/66	245MB	\$1749

Color VGA monitors from \$229.99

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LEADING EDGE

486 WinTower

- Upgradeable 486, 4MB RAM
- 1.44MB and 1.2MB floppy drives
- Local bus slot, 1MB video RAM

Processor	Hard Drive	Price
SX25	213MB	\$1259
SX33	130MB	\$1199
DX33	130MB	\$1379
DX33	213MB	\$1459
DX2/50	213MB	\$1599
DX2/66	213MB	\$1789

Color VGA monitors from \$229.99

Lease for \$50/mo.

\$1199



AST

Bravo Desktops

- 4MB RAM expandable to 64MB
- 120MB hard drive
- MS-DOS, Windows 3.1, MS Mouse

Processor	Model	Price
4/25	213/3W	\$1459
4/33		\$1819
4/50d		\$2199
4/66d		\$2269

Bundles include AST SVGA color monitor

Lease for \$50/mo.

\$1459



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DESKPRO/i 4/25is

- 25 MHz 486SX
- 4MB RAM
- 120MB hard drive
- 3.5" floppy drive
- QVision graphics controller
- Business audio
- MS-DOS, Windows 3.1, mouse

\$1499
240MB configuration
\$1689

Compaq SVGA color monitor \$349.99

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\$1499



COMPAQ

ProLinea 486DX/50

- 4 MB RAM
- 3.5" and 5.25" floppy drives
- MS-DOS, Windows 3.1
- PFS:Window/Works
- Compaq mouse

Processor	Hard Drive	Price
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486DX/50	240MB	\$1729

Compaq SVGA color monitor \$349.99

Lease for \$56.11/mo.

\$1529



COMPAQ

DESKPRO/M

- 4.32bit EISA expansion slots
- Intelligent modularity
- QVision graphics controller
- MS-DOS, windows 3.1, mouse

Processor	RAM	Price
486SX25	4MB	\$2129
486DX33	4MB	\$2469
486DX2/66	8MB	\$3739

Compaq SVGA color monitor \$349.99

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\$2129



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Premiera Desktops

- 8MB RAM expandable to 128MB
- 5 EISA slots, 5 drive bays
- 1.44MB 3.5" floppy drive
- Local bus, 1280x1024 resolution
- MS-DOS, Windows 3.1, MS mouse

Processor	Drive	Price
4/33	170MB	\$2579
4/66d	340MB	\$3329

AST SVGA color monitor \$429.99

Lease for \$94.64/mo.

\$2579



AST

Premium SE Server

- 10 EISA expansion slots
- SCSI backplane
- Integrated video 1280x1024

Processor	RAM/Drive	Model	Price
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4/66d	16MB/1GB	1003	\$5999

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Toshiba has been an industry innovator since its introduction of the first commercially accepted DOS-based portable in 1985. Always responsive to user demands for more power, lighter weight, and increased capabilities, Toshiba has introduced a broad range of technological innovations to the marketplace, including active matrix color technology. Toshiba active matrix color notebooks deliver up to 256 simultaneous colors at 640x480 resolution from a palette of up to 185,193 colors. Explore a full range of powerful, lightweight Toshiba notebooks and accessories implementing breakthrough technology, now available from your super direct source.



TOSHIBA

T4500

- 4MB RAM, expandable to 20MB
- PCMCIA slot
- 6.4 lbs.
- MS-DOS, Windows, Trackball

Processor	Hard drive	Price
486SX20	120MB	\$1589
486SX20 Color	120MB	\$1799

Lease for \$95.01/mo.

\$2589



TOSHIBA

T4400C COLOR

- 25MHz 486SX
- 4MB RAM, expandable to 20MB
- 120MB hard drive
- 9.5" active matrix color display

- 25MHz 486DX
- 200MB configuration

Lease for \$124.74/mo.

\$3399



TOSHIBA

T6400

- 4 MB, expandable to 36MB
- Full 101-key keyboard
- One full-length expansion slot

Processor	Hard Drive	Price
486DX2/50 plasma	200MB	\$1649
486DX2/50 color	200MB	\$1899

Lease for \$148.59/mo.

\$4049

ACTIVE MATRIX COLOR DISPLAY



BRIGHTEST IN THE INDUSTRY



Toshiba MaxTime Power Management

MaxTime Power Management coordinates all hardware and software system elements to extend battery life. MaxTime allows Toshiba notebooks to operate in normal full power mode or in either of two standard power saving modes, or in a custom user-defined mode. In the power saving modes, select processing speed, display brightness and auto-off settings, and hard drive power down when not in use.

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 - 8KB cache, 2 PCMCIA slots
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- | Screen | Hard drive | Model | Price |
|--------------|------------|-------|--------|
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TravelMate 4000 Color

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 - Simultaneous SVGA display
 - Microsoft Ballpoint trackball
 - MS-DOS 5.0, Windows 3.1
- | Processor | RAM | Hard Drive | Price |
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LTE Lite/25E

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 - 64KB cache
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 - Built-in trackball
- | |
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- | |
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80387-40	200	80387-40	200	80387-40	200
80387-50	240	80387-50	240	80387-50	240
80387-60	280	80387-60	280	80387-60	280
80387-70	320	80387-70	320	80387-70	320
80387-80	360	80387-80	360	80387-80	360
80387-90	400	80387-90	400	80387-90	400
80387-100	440	80387-100	440	80387-100	440
80387-110	480	80387-110	480	80387-110	480
80387-120	520	80387-120	520	80387-120	520
80387-130	560	80387-130	560	80387-130	560
80387-140	600	80387-140	600	80387-140	600
80387-150	640	80387-150	640	80387-150	640
80387-160	680	80387-160	680	80387-160	680
80387-170	720	80387-170	720	80387-170	720
80387-180	760	80387-180	760	80387-180	760
80387-190	800	80387-190	800	80387-190	800
80387-200	840	80387-200	840	80387-200	840
80387-210	880	80387-210	880	80387-210	880
80387-220	920	80387-220	920	80387-220	920
80387-230	960	80387-230	960	80387-230	960
80387-240	1000	80387-240	1000	80387-240	1000
80387-250	1040	80387-250	1040	80387-250	1040
80387-260	1080	80387-260	1080	80387-260	1080
80387-270	1120	80387-270	1120	80387-270	1120
80387-280	1160	80387-280	1160	80387-280	1160
80387-290	1200	80387-290	1200	80387-290	1200
80387-300	1240	80387-300	1240	80387-300	1240
80387-310	1280	80387-310	1280	80387-310	1280
80387-320	1320	80387-320	1320	80387-320	1320
80387-330	1360	80387-330	1360	80387-330	1360
80387-340	1400	80387-340	1400	80387-340	1400
80387-350	1440	80387-350	1440	80387-350	1440
80387-360	1480	80387-360	1480	80387-360	1480
80387-370	1520	80387-370	1520	80387-370	1520
80387-380	1560	80387-380	1560	80387-380	1560
80387-390	1600	80387-390	1600	80387-390	1600
80387-400	1640	80387-400	1640	80387-400	1640
80387-410	1680	80387-410	1680	80387-410	1680
80387-420	1720	80387-420	1720	80387-420	1720
80387-430	1760	80387-430	1760	80387-430	1760
80387-440	1800	80387-440	1800	80387-440	1800
80387-450	1840	80387-450	1840	80387-450	1840
80387-460	1880	80387-460	1880	80387-460	1880
80387-470	1920	80387-470	1920	80387-470	1920
80387-480	1960	80387-480	1960	80387-480	1960
80387-490	2000	80387-490	2000	80387-490	2000
80387-500	2040	80387-500	2040	80387-500	2040
80387-510	2080	80387-510	2080	80387-510	2080
80387-520	2120	80387-520	2120	80387-520	2120
80387-530	2160	80387-530	2160	80387-530	2160
80387-540	2200	80387-540	2200	80387-540	2200
80387-550	2240	80387-550	2240	80387-550	2240
80387-560	2280	80387-560	2280	80387-560	2280
80387-570	2320	80387-570	2320	80387-570	2320
80387-580	2360	80387-580	2360	80387-580	2360
80387-590	2400	80387-590	2400	80387-590	2400
80387-600	2440	80387-600	2440	80387-600	2440
80387-610	2480	80387-610	2480	80387-610	2480
80387-620	2520	80387-620	2520	80387-620	2520
80387-630	2560	80387-630	2560	80387-630	2560
80387-640	2600	80387-640	2600	80387-640	2600
80387-650	2640	80387-650	2640	80387-650	2640
80387-660	2680	80387-660	2680	80387-660	2680
80387-670	2720	80387-670	2720	80387-670	2720
80387-680	2760	80387-680	2760	80387-680	2760
80387-690	2800	80387-690	2800	80387-690	2800
80387-700	2840	80387-700	2840	80387-700	2840
80387-710	2880	80387-710	2880	80387-710	2880
80387-720	2920	80387-720	2920	80387-720	2920
80387-730	2960	80387-730	2960	80387-730	2960
80387-740	3000	80387-740	3000	80387-740	3000
80387-750	3040	80387-750	3040	80387-750	3040
80387-760	3080	80387-760	3080	80387-760	3080
80387-770	3120	80387-770	3120	80387-770	3120
80387-780	3160	80387-780	3160	80387-780	3160
80387-790	3200	80387-790	3200	80387-790	3200
80387-800	3240	80387-800	3240	80387-800	3240
80387-810	3280	80387-810	3280	80387-810	3280
80387-820	3320	80387-820	3320	80387-820	3320
80387-830	3360	80387-830	3360	80387-830	3360
80387-840	3400	80387-840	3400	80387-840	3400
80387-850	3440	80387-850	3440	80387-850	3440
80387-860	3480	80387-860	3480	80387-860	3480
80387-870	3520	80387-870	3520	80387-870	3520
80387-880	3560	80387-880	3560	80387-880	3560
80387-890	3600	80387-890	3600	80387-890	3600
80387-900	3640	80387-900	3640	80387-900	3640
80387-910	3680	80387-910	3680	80387-910	3680
80387-920	3720	80387-920	3720	80387-920	3720
80387-930	3760	80387-930	3760	80387-930	3760
80387-940	3800	80387-940	3800	80387-940	3800
80387-950	3840	80387-950	3840	80387-950	3840
80387-960	3880	80387-960	3880	80387-960	3880
80387-970	3920	80387-970	3920	80387-970	3920
80387-980	3960	80387-980	3960	80387-980	3960
80387-990	4000	80387-990	4000	80387-990	4000
80387-1000	4040	80387-1000	4040	80387-1000	4040
80387-1010	4080	80387-1010	4080	80387-1010	4080
80387-1020	4120	80387-1020	4120	80387-1020	4120
80387-1030	4160	80387-1030	4160	80387-1030	4160
80387-1040	4200	80387-1040	4200	80387-1040	4200
80387-1050	4240	80387-1050	4240	80387-1050	4240
80387-1060	4280	80387-1060	4280	80387-1060	4280
80387-1070	4320	80387-1070	4320	80387-1070	4320
80387-1080	4360	80387-1080	4360	80387-1080	4360
80387-1090	4400	80387-1090	4400	80387-1090	4400
80387-1100	4440	80387-1100	4440	80387-1100	4440
80387-1110	4480	80387-1110	4480	80387-1110	4480
80387-1120	4520	80387-1120	4520	80387-1120	4520
80387-1130	4560	80387-1130	4560	80387-1130	4560
80387-1140	4600	80387-1140	4600	80387-1140	4600
80387-1150	4640	80387-1150	4640	80387-1150	4640
80387-1160	4680	80387-1160	4680	80387-1160	4680
80387-1170	4720	80387-1170	4720	80387-1170	4720
80387-1180	4760	80387-1180	4760	80387-1180	4760
80387-1190	4800	80387-1190	4800	80387-1190	4800
80387-1200	4840	80387-1200	4840	80387-1200	4840
80387-1210	4880	80387-1210	4880	80387-1210	4880
80387-1220	4920	80387-1220	4920	80387-1220	4920
80387-1230	4960	80387-1230	4960	80387-1230	4960
80387-1240	5000	80387-1240	5000	80387-1240	5000
80387-1250	5040	80387-1250	5040	80387-1250	5040
80387-1260	5080	80387-1260	5080	80387-1260	5080
80387-1270	5120	80387-1270	5120	80387-1270	5120
80387-1280	5160	80387-1280	5160	80387-1280	5160
80387-1290	5200	80387-1290	5200	80387-1290	5200
80387-1300	5240	80387-1300	5240	80387-1300	5240
80387-1310	5280	80387-1310	5280	80387-1310	5280
80387-1320	5320	80387-1320	5320	80387-1320	5320
80387-1330	5360	80387-1330	5360	80387-1330	5360
80387-1340	5400	80387-1340	5400	80387-1340	5400
80387-1350	5440	80387-1350	5440	80387-1350	5440
80387-1360	5480	80387-1360	5480	80387-1360	5480
80387-1370	5520	80387-1370	5520	80387-1370	5520
80387-1380	5560	80387-1380	5560	80387-1380	5560
80387-1390	5600	80387-1390	5600	80387-1390	5600
80387-1400	5640	80387-1400	5640	80387-1400	5640
80387-1410	5680	80387-1410	5680	80387-1410	5680
80387-1420	5720	80387-1420	5720	80387-1420	5720
80387-1430	5760	80387-1430	5760	80387-1430	5760
80387-1440	5800	80387-1440	5800	80387-1440	5800
80387-1450	5840	80387-1450	5840	80387-1450	5840
80387-1460	5880	80387-1460	5880	80387-1460	5880
80387-1470	5920	80387-1470	5920	80387-1470	5920
80387-1480	5960	80387-1480	5960	80387-1480	5960
80387-1490	6000	80387-1490	6000	80387-1490	6000
80387-1500	6040	80387-1500	6040	80387-1500	6040
80387-1510	6080	80387-1510	6080	80387-1510	6080
80387-1520	6120	80387-1520	6120	80387-1520	6120
80387-1530	6160	80387-1530	6160	80387-1530	6160
80387-1540	6200	80387-1540	6200	80387-1540	6200
80387-1550	6240	80387-1550	6240	80387-1550	6240
80387-1560	6280	80387-1560	6280	80387-1560	6280
80387-1570	6320	80387-1570	6320	80387-1570	6320
80387-1580	6360	80387-1580	6360	80387-1580	6360
80387-1590	6400	80387-1590	6400	80387-1590	6400
80387-1600	6440	80387-1600	6440	80387-1600	6440
80387-1610	6480	80387-1610	6480	80387-1610	6480
80387-1620	6520	80387-1620	6520	80387-1620	6520
80387-1630	6560	80387-1630	6560	80387-1630	6560
80387-1640	6600	80387-1640	6600	80387-1640	6600
80387-1650	6640	80387-1650	6640	80387-1650	6640
80387-1660	6680	80387-1660	6680	80387-1660	6680
80387-1670	6720	80387-1670	6720	80387-1670	6720
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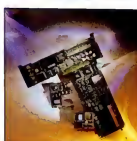
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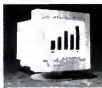
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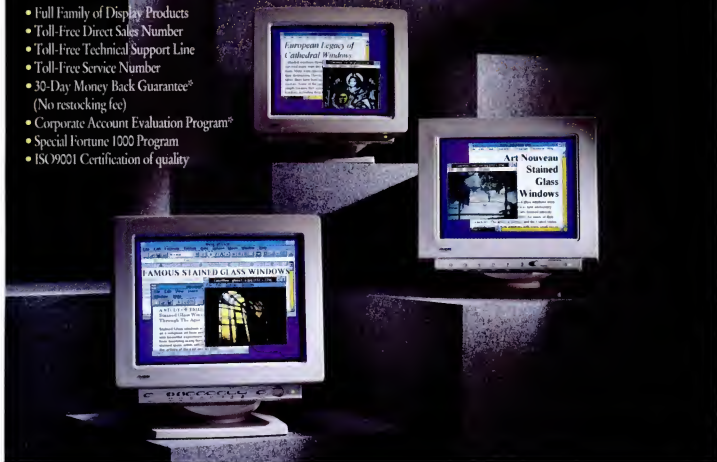
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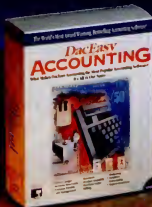


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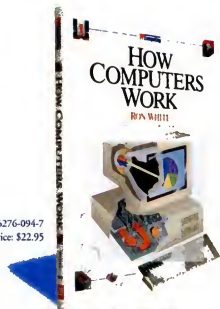


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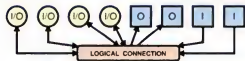
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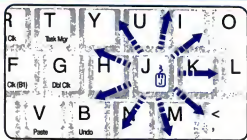
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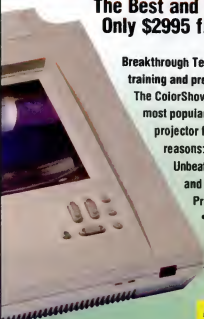
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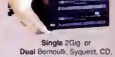
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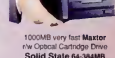
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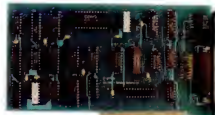
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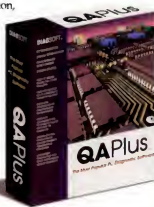
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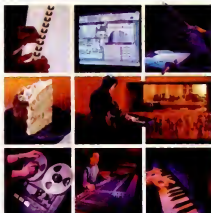


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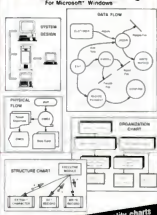
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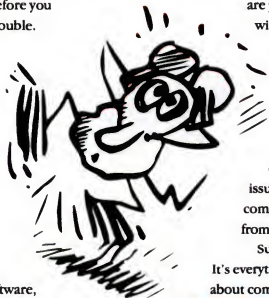
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Coming Up

The Good, the Bad, and the SCSI

Everything you always wanted to know about SCSI but were afraid to ask. *PC Magazine* gives an in-depth explanation of what SCSI is and what it can do for you.

RAID to the Rescue

With the ever-expanding reach of networks into the workplace comes a need to maintain data integrity and guard against the potentially catastrophic results of hard disk failure. *PC Magazine* looks at six RAID solutions for NetWare networks that promise to protect against data loss and to maintain uninterrupted system operation during the repair and restoration process.

V.32bis Modems

V.32bis modems using data compression and error control can transfer data at up to 57.6 kilobits per second. Last time we reviewed these superfast modems, there were just 14 on the market. Now over 60 varieties are available. Our technology-oriented primer dissects the results of ZD Labs' rigorous modem performance testing and explains how to choose the modem most appropriate for your needs and budget.

Enter the First Pentium Systems

What's emerging from R&D labs, heading for tomorrow's offices? How much faster will the Pentium systems be? What tricks will be required to get the most out of the new chip? *PC Magazine* examines what's on and what's missing from the first desktop and server systems engineered for Intel's eagerly awaited processor.

Document Management

Keeping track of your company's letters, reports, memos, and other documents usually means frazzled secretaries shuffling through mountains of paper in poorly organized file cabinets. *PC Magazine* tests four document management products designed to track and catalog documents from creation to storage and help find that elusive needle in the paperwork haystack.

Free Utility

What do you do with a file created with a word processor you don't have? PCMCVT, our next issue's utility, lets you convert it into a straight ASCII text file so you can easily read it in five popular word processors: Ami Pro for Windows and both the DOS and Windows versions of Word and WordPerfect. □

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Reader Service

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After Hours

SCIENCE: Body Illustrated, Operation: Frog, Quarky & Quaysoo's Turbo Science, Chemistry Works

SCIENCE SOFTWARE

From Anatomy to Zoology: Scientific Method Meets the PC

BY PETER SCISCO

When students need help with their science homework, it is little wonder that adults send them straight to the library. Now you can send them to the PC instead: Science education programs cover everything from chemistry and physics to the beating of the human or amphibian heart.

The four programs in this roundup, *Body Illustrated*; *Operation: Frog*; *Quarky & Quaysoo's Turbo Science*; and *Chemistry Works* offer a variety of perspectives on science. *Body Illustrated* takes the user on a colorful journey into the human anatomy, while *Chemistry Works* provides a rather dry but thorough textbook account of the periodic table of elements. *Operation: Frog* takes the mess out of the dissection ritual, and *Quarky & Quaysoo's Turbo Science* takes an MTV-like approach to the basics of science, making it fun for elementary and junior high school children.

The root of all science is observation and experimentation. And, not to make light of the sorry state of scientific knowledge among the general population, there's a fair amount of fun involved in science exploration as well.

That's where science soft-

ware can excel. The best of these programs entertain children and young adults not only with animation, color, and sound, but with the knowledge of science itself.

SPIRIT OF DISCOVERY

Body Illustrated

With *Body Illustrated*, from *Spirit of Discovery*, anatomy students can tour the human body, from the abducens nerve, which controls the sideways rotation of the eyeball, to the zygomatics—or cheekbones. Clear, 256-color illustrations—many providing front, back, left, right, top, and bottom views—combined with short but excellently written explanatory notes, help create a good learning atmosphere.

EXPLORING THE BODY

Body Illustrated contains five operational modes: an exploration section, a full set of anatomy lessons, an encyclopedia, a game, and a tutorial mode that serves as a guided tour of the other four options. The modes contain essentially the same information, but each provides a different way of learning.

The exploration section is the least restrictive, allowing students to examine at leisure

any part of the human anatomy. You can choose one of 13 anatomical subdivisions, such as the skeletal, digestive, reproductive, or cardiovascular systems. Each subdivision begins with a general overview and a display that locates the system in relation to the entire human body.

The fantastic voyage within this mode begins when you start to click directly on the anatomical illustrations that accompany the program's written descriptions. Interactive graphics respond to mouse clicks and pointer movements, delving deeper and deeper into the human anatomy. Moving the pointer

biology class. Anyone who completes all 13 of these lessons will have a solid understanding of the human anatomy. The lessons provide detailed and methodical explanations of the parts of each of the 13 systems, and describe how those parts work together to achieve their anatomical purpose.

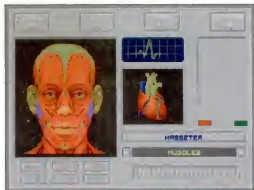
A lesson about the digestive system, for example, starts with an overview, then begins a journey through the alimentary canal at the mouth. From here, the student moves to the pharynx, then down the esophagus to the stomach. The lesson continues by moving through the pyloric orifice,

into the small intestine, into the large intestine, and, finally, to the colon and rectum, providing information along every step of the way. Accessory organs that are not part of the system, but work with the system (such as the salivary glands, in this example), are also discussed.

For 9 of the 13 systems, a 10-question quiz follows the lessons. This quiz tests the student's ability to identify parts of the system just learned. Unfortunately, there is no way to save a test score to compare with previous quizzes, or to track the student's process.

STANDARD MEDICAL TERMS

Body Illustrated does not shrink from the complexities of human anatomy. The program uses standard medical and anatomical references



Anatomical exploration: *Body Illustrated* shows the major muscles, bones, and organs of the human body.

over the respiratory system, for example, causes the upper respiratory system to appear in red and lower respiratory system in blue. You can explore the lungs, trachea, bronchi, and larynx by clicking on the blue region, or by selecting one of the corresponding choices on a menu to the right of the diagram.

Body Illustrated's Lesson mode is quite comprehensive, and is equal in scope to a good

Body Illustrated

and terms, which will be unfamiliar to most users. Unfortunately, however, there is no convenient way to look up many of those terms. A word search, which is accessed by clicking on the help button, aids users in finding the illustrated body parts, but hyper-text and a more comprehensive dictionary would be useful.

To its credit, *Body Illustrated* does provide a digitized speech pronunciation guide, since many anatomical terms are difficult for students to pronounce correctly (*olfactory epithelium*, for example). Though the program recognizes Sound Blaster and compatible cards, the computer's internal speaker provides fairly clear audio. One glaring oversight of this feature is the lack of pronunciation cues in the text itself, even in the encyclopedia.

Even without those cues, the encyclopedia makes a fine on-line reference. More than 350 anatomical terms are listed, with brief descriptions and illustrations. This is perhaps the most utilitarian part of the program.

Once a student has attained proficiency, a game module similar in design to the lessons' quiz sections lets up to 10 players compete in a race to find a series of body parts. The fewer times a player clicks on the display, the higher the point score. All players compete against a 30-second clock; the three skill levels (easy, medium, and hard) can be set individually, to handicap better players.

Throughout, *Body Illustrated* very effectively shares the core of its information among its different modules. Even though the text and pic-

tures remain the same, the different perspectives provided by each module create a broader approach to the information than might be gained from a traditional illustrated text. This program is an excellent example of how interactive programs can succeed as teaching tools.

Body Illustrated, \$79.95.

Requires: 640K RAM, DOS 3.0 or later, 3MB hard disk space. *Spirit of Discovery*, 5421 Avenida Encinas, Carlsbad, CA 92008; 800-722-8988, 619-929-2010; fax, 619-929-2035.

Circle 456 on reader service card

HI-TECH EXPRESSIONS

Operation: Frog

Not too many months ago, the *New York Times Magazine* reported that countless numbers of frogs have vanished from their habitats around the world; scientists continue to disagree on the reasons behind the absconding amphibians. Meanwhile, introductory biology students—without frogs to dissect—could very well feel the effects of this mystery.

Operation: Frog, an inexpensive DOS-based program from Hi-Tech Expressions, may provide some relief. This \$24.95 program replaces our real pond-dwelling brethren with computer models suitable for home or classroom use. The dissection simulation has two objectives: to open a frog and remove its organs in the correct order, and to examine the extracted parts to see how they function and work together. Using a standard set of dissection tools (scissors, probe, magnifying glass, and for-

ceps), students can study a frog's anatomy without wax-lined biology trays or dangerous scalpels. The dissection simulation serves as a good primer on anatomy; for extra reinforcement, students can even reconstruct the little guy. Try that with a real frog.

At the start of the program, the frog lies belly-up at the left of the screen. The toolbox and dissection tray are at the right. In order to dissect properly, the student must locate the correct incision and snip points by using the probe (activating the probe tool as it is passed over the frog highlights the correct spots). Once the points are found, the student uses the scissors to make the proper incisions. After a few correct cuts, the frog's interior is displayed.

The first organs to be removed are the heart, the bladder, and the liver. To proceed, the student again activates the probe over the frog; doing so identifies the organ and indicates the proper clip point for removal. The frog's interior is laid out much like a transparency in a biology reference

and move it to the dissection tray. The tray contains the outlines of the various organs so that the student can keep track of what has been removed and what remains.

Once the student places an organ in the dissection tray, it can be examined more closely with the magnifying glass. Using this tool, the student can bring up a color display of the organ that labels the various elements, describes the organ's purpose, and explains how it works. At this point, the student may compare the organ with its human counterpart, which is the reason for all of this dissection in the first place. The organ display screens also allow entrance to the game's index, an alphabetical listing of anatomical parts. The student can use the index as a study guide.

NO DISTRACTIONS

Operation: Frog doesn't try to do too much, and sticks to its classroom roots with a simple interface, effective use of color, and brief animated sequences that teach. There are no distracting sound effects or theme music. The program should be welcomed by parents looking for an introductory anatomy package for their children.

Of course, *Operation: Frog* doesn't pretend to duplicate the experience of dissecting a real frog. A real dissection involves a different kind of skill, as well as attention to such details as removing the animal's skin after the initial incision has been made. *Operation: Frog* is also missing certain bones and muscles: The important systems are labeled, but those systems' individual parts are not there.



Dissection without the mess: Operation: Frog teaches basic biology principles.

book, with different layers visible at different points in the dissection procedure.

Once students locate the clip point, they can use the scissors to snip the organ free and the forceps to pick it up

Operation: Frog

During a real dissection in a classroom environment, a student may be required to locate a specific organ and remove it. To follow such instructions successfully, a student must already possess some basic knowledge of the frog's anatomy. With Operation: Frog, that knowledge isn't necessary; as long as a clip point can be found, the student can snip the organ free—even if that student can't identify the organ.

Despite these obvious shortcomings, the program can supplement an actual dissection and can provide a good anatomy lesson in the process. Now, if it could only solve the mystery of the vanishing frogs.

Operation: Frog, \$24.95. Requires: 256K of RAM, DOS 2.1 or later, Hi-Tech Expressions, 584 Broadway, New York, NY 10012; 212-941-1224; fax, 212-941-1521.

Circle 457 on reader service card

SIERRA ON-LINE

Quarky and Quaysoo's Turbo Science

Quarky and Quaysoo's Turbo Science capitalizes on fun in a frenetic, science-based race game for kids 9 to 14 years old. The form of the game is a race between two teams—one of computer opponents, the other one of the title characters and the user.

Teams compete by answering general and specific questions about the physical sciences. Correct answers earn money, which can be used to buy transportation to the racetrack's next checkpoint. Reach the checkered flag first and you win the race; rack up several wins and you move up in rank and compete against

more challenging adversaries.

The user can adjust the game's difficulty, by choosing hard or easy questions. The easy questions deal mostly with quantities or properties that can be measured, or they can be answered by examining the pictures on the screen. At the harder level, more of the questions require some deductive reasoning.

Marketed as part of Sierra On-Line's Sierra Discovery Series, the \$49.95 Turbo Science is more than a game. The

information is straightforward, accurate, and amazingly thorough. These folks should write some textbooks. In fact, this guide should be a textbook.

FRANTIC PACE

Conservative parents may be uncomfortable with Turbo Science's frantic pace, blaring rock track, and slang-heavy text. The program may not be suitable for kids who are easily distracted or who must cope with an attention-deficit disorder. Likewise, it's assumed

that kids can tell when a passage in the Research Guide is written in a character's voice rather than as a model of perfect grammar. Hector Skullface (a dead ringer for Frankenstein), for example, speaks monstrous English, broken by expressions like "BIG FUN!!!"

At the same time, he does a fine job of teaching the principles of electromagnetism and static electricity.

The program's most serious omission comes in the Research Guide's section on famous scientists, which lists no women. Although female characters are well-represented throughout the guide, Marie Curie (Nobel Prize in chemistry, 1911), Sally Ride, and others miss a chance to inspire young women to careers in science. Also lacking is a two-player mode that would let teams of kids compete against one another.

Any real scientist knows that science is a game, but it took a software company to turbo-charge the scientific method. Ms. Wizard might be annoyed that she's not in the

game's Hall of Fame, but Mr. Wizard will never be the same.

Quarky and Quaysoo's Turbo Science, \$49.95. Requires: 640K RAM, DOS 3.0 or later, 8MB hard disk space. For Ages 9 to 14. Sierra On-Line, P.O. Box 485 Coarsegold, CA 93614; 800-326-6654.

Circle 458 on reader service card

SOFTWARE MARKETING CORP.

Chemistry Works

The title is reminiscent of a DuPont advertisement, but Chemistry Works from Software Marketing Corp. is a serious science reference tool for budding chemists and professionals. Based on the periodic table of 108 natural and synthetic elements, Chemistry Works becomes an interactive text for reference and study.

An understanding of chemistry is essential for students interested in pursuing careers in areas ranging from horticulture to pharmacy. But the language of atoms and molecules can deter even the most ambitious student. By providing several different ways to get to the necessary information, Chemistry Works can help students see the relationships between elemental properties and periodic table placement.

Any query starts at the main screen, a display of the periodic table. From here, the user may select any of the elements to see a detailed report, which includes the element's atomic weight, the chemical group to which the element belongs, and the physical state in which it naturally exists. While most of this information should be part of any decent textbook, Chemistry Works improves on many standard texts with its details: There are 22 distinct properties that are quantified. Furthermore, the



Correct answers to Turbo Science's questions propel Quarky and Quaysoo toward the finish line.

program employs observation, experimentation, and hypothesis within a radical, colorful framework that should interest almost any kid. After all, science is more than lab charts and beakers. The game has all the tools kids need to pursue the scientific method, including a toolkit with such devices as a scale, measuring tape, and voltage, light, and sound meters. Turbo Science actually encourages use of the toolkit, by stopping the clock while kids measure and weigh objects to test their theories.

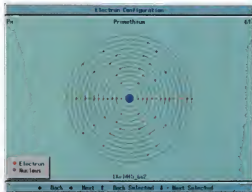
Likewise, there's no penalty for using the Research Guide, a 152-page book that, once opened, is hard to put down. The guide is designed and written to appeal to kids whose idea of literature is the song list from the back of a Guns 'n' Roses CD, but the in-

Chemistry Works

program offers extra information in the form of spectral analysis, electron configuration, crystal structure, and a list of isotopes. And as with all good computerized reference material, Chemistry Works also lets users search for specific items in ways no textbook can match.

All of this information is essential to mastering chemistry, but the program misses several opportunities to do even more. Documentation is sparse, and although an on-line glossary alleviates some of the problems, there is no general index. For example, a student who is curious about the electronegativity of neon (a noble, or inert, gas) will notice that this property is

marked with an asterisk. But clicking on electronegativity only brings up a glossary entry: Electronegativity is the element's ability to attract outside electrons to become negatively



Available: A display of Promethium's shell configuration shows which electrons may attract other elements.

charged. There is simply no explanation for the asterisk. Therefore, the user would have to realize that, by definition, inert gases have no electronegativity. The glossary is not linked

with any hypertext, so terms cannot be cross-referenced from one entry to another.

Chemistry Works fares much better with its database query features. Selecting search criteria is a pretty straightforward process and writing the queries themselves is simplified with a push-button interface.

Typed queries are also allowed. The syntax guidelines should pose very few problems, especially after a few initial searches have been completed.

COMPARING PROPERTIES

Related to the database query feature is a graphing function, which students can use to compare properties of the elements they've selected. Only line and bar graphs can be

created, and there's no way to print the graphs or export them to a file. Reports, which are created in a way similar to making database queries (and which list data in a columnar format) can be printed or saved to an ASCII file.

Chemistry Works forgoes frills in favor of detailed information. As a tool for professionals, it can certainly replace reference works with its quick access to data. But the lack of a general index limits its use to students in more advanced stages of study. □

Chemistry Works, \$69.95.

Requires: 640K of RAM, DOS 3.3 or later, 1.5MB hard disk space. Software Marketing Corp., 9830 South 51st St., Bldg. A-131, Phoenix, AZ 85044; 602-893-2400; fax, 602-893-2042.

Circle 459 on reader service card

MOVING?

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Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Robin Raskin

20MB to Potty-Train; At What Cost College?

I love my kids, but a megabyte is a megabyte. The Berenstain Bears: Learning at Home requires 20MB. (Compton's New-Media Inc., 619-929-2500.)



Next in the Sierra Lineup: Yasir Arafat's Middle East?

(This is a real press release—really!)

"Entertainment software developer and publisher Sierra On-Line announced today the signing of a publishing agreement with Daryl Gates, former Chief of the Los Angeles Police Department.

"Gates' design for the next installment of the *Police Quest* series puts game players in the role of a present-day LAPD detective tracking down the source of seemingly random murders. By-the-book procedures and real world pressures from the media and public play a dominant part in the game. The game will also feature photo-realistic backgrounds and video-captured actors....

"Chief Gates said, 'I want to give computer users the opportunity to see what it's like to be a cop in L.A. I want to show the day to day pressures officers face and provide an accurate picture of the dangers and difficulties they encounter in trying to solve a crime.'"

If your entry is used in Abort, Retry, Fail? we'll send you \$50 and a PC Magazine T-shirt. Winners this issue: Julie Cohen (the sinister Sierra), Amin Murji (legal eagles), Marty Macher (a computer is hatched).

SMILEYS



I Second That Emoticon

Emoticons, or smileys, are used in e-mail and other communications. *Smileys*, a book of over 650 of these sideways outpourings compiled by David Sanderson, provides the ultimate guide. Take the Smiley test:

1. *<:-)	a. confused
2. =^)	b. frog
3. [-:)	c. wizard
4. 8=:-)	d. Santa Claus
5. 8)	e. Ronald Reagan
6. %\v	f. Mousketeer
7. -=#:-)	g. Dagwood Bumstead
8. 8(-:)	h. ha ha!
9. %(-	i. partied all night
10. :-)	j. chef
11. #-)	k. listening to walkman
12. 7:^\)	l. Picasso

Answers:

1=d, 2=g, 3=b, 4=k, 5=b, 6=l, 7=c, 8=f, 9=a, 10=j, 11=e, 12=a

Spontaneous Evolution

"According to Sternberg, the discovery of the LAN Safety came by accident when two computer programs were left running... and accidentally merged."

—THE FARMINGTON VALLEY HERALD (CONNECTICUT), JANUARY 28, 1993



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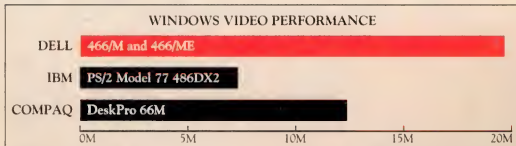
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Performance measured by running WINBENCH version 3.1 at 640 x 480, 256 colors. Results measured in millions of WINMARKS. Results for IBM and Compaq as published by PC Magazine in issue dated January 26, 1993. Results for Dell 466/M and 466/ME provided by Dell Performance Measurement Lab, January 1993. DeskPro 66M configured with 8MB RAM, 210MB IDE HD, QVision 1024/E controller with 1MB VRAM. PS/2 model 77 486DX2 configured with 8MB RAM, 400MB 9.5" HD, XGA-2 with 1MB VRAM and 256KB cache. 466/M and 466/ME both configured with 8MB RAM, 170MB IDE HD, local bus video with 1MB VRAM, and 128KB cache.

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